Gordon Institute of Business Science
University of Pretoria

The mediating effect of environmental dynamism on complexity leadership and dynamic capabilities: it takes three to tango.

Nduvho Kutama

19407468

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ABSRACT

The modern business environment is complex, dynamic, and has unpredictable moments. This is creating adaptive challenges for leaders worldwide and enhancing the need for organisational adaptability, complex responses and leadership with adaptive competencies.

Leadership remains at the centre of enabling renewal, reconfiguration and adapting to changing market conditions. Operational capabilities facilitate efficiency and are geared for stable environment. Faced with unpredictable environments, dynamic capabilities offer a solution for leaders and organisations. As a result, there is a need to expand knowledge on understanding the mediating role of environmental dynamism on the relationship complexity leadership has with dynamic capabilities. This study examined the mediating effect environmental dynamism had in the relationship complexity leadership has with dynamic capabilities.

This study aims to uncover some untapped potential complexity leadership offers to dynamic capabilities. Findings from this study could contribute to leadership development in organisations seeking to adapt and increase competitiveness. Leadership in firms will benefit from knowing and using complexity leadership traits to influence organisational outcomes.

Using SEM, 953 responses were collected using an electronic survey and statistically analysed to test the hypothesised mediation. The results indicated environmental dynamisms partially mediation the relationship complexity leadership has with dynamic capabilities. Understanding the role of dynamic capabilities and complexity leadership in achieving competitive advantage will benefit both academia and practice.

Key words: Complexity leadership, adaptability, dynamic capabilities, environmental dynamism

Declaration

I declare that this research project is my own work. It is submitted in partial fulfilment of the requirements for the degree of Master of Philosophy (Corporate Strategy) at the Gordon Institute of Business Science, University of Pretoria. It has not been submitted before for any degree or examination in any other University. I further declare that I have obtained the necessary authorisation and consent to carry out this research.

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Name & Surname Signature

Table of Contents

1. Chapter 1: Introduction to Research Problem

1.1. Introduction to the research problem

“A butterfly in the Amazon might, in principle, ultimately alter the weather in Kansas” (Kauffman, 1993, p. 215). This is known as the butterfly effect. It illustrates how a single event or changes in one variable can have disproportionally large and unpredictable effects on other variables (Schneider & Somers, 2006). Information and effects are transmitted quicker in an interconnected and layered system or network. As the world increasingly connects, effects from one corner of the globe can spread to other corners and create unprestatable (Kauffman & Gare, 2015) and unpredictable outcomes. As an example, the emergence of the novel coronavirus has had far-reaching and unforeseen effects in many corners of the world (Crick & Crick, 2020; Ritter & Pedersen, 2020; World Health Organization, 2020). It has turned the VUCA (volatile, uncertain, complex, and ambiguous) world upside down. This dramatic social change (de la Sablonnière, 2017) has created a fractal like effect of simultaneously affecting multiple layers of society (Longo, Montévil, & Kauffman, 2012) and displaying no statistical difference between the layers– it is scale invariant and shows a lack of distinctive difference across levels (McBride, 2016; Uhl-Bien & Arena, 2018).

The modern business environment is continually changing, primarily driven by technological advancement, innovation, globalisation, increasing information transparency, and lately, the novel coronavirus (Ritter & Pedersen, 2020; Scheepers & Swart, 2020; Uhl-Bien & Arena, 2018). This dynamism is creating a complex and unpredictable environment for firms and leadership alike, the leadership role of coordinating resources is increasingly becoming challenging (Jansen, van den Bosch, & Volberda, 2006; Uhl-Bien & Arena, 2018). “Change is happening so fast it is hard to predict who your competitors are. Assumptions that seemed iron clad 12 months ago are obsolete today” (Osborne & Hinson, 2011, p. 26). Diagnosing the correct context matters because it affects the type of decision made and required which can be context specific and not generic (Duncan, 1972; Osborne & Hinson, 2011; Snowden & Boone, 2007). A mismatch been the context and the response can create ineffective decisions and outcomes such as analysis-paralysis, missing opportunities for implementing innovation and change, and misplaced habitual command-and-control approaches instead of exploiting and soliciting knowledge from the organisational network (Hannah et al., 2009; Kutz, 2008; Kutz & Bramford-Wade, 2013; Snowden & Boone, 2007).

As complexity increases, wise leaders take the internal and external context into

account their decision making (Snowden & Boone, 2007). They understand that in a complex context, there are many dynamic, interconnected and moving elements that interact in a non-linear manner (butterfly effect) where “hindsight does not lead to foresight” and prediction of the future is misplaced (Snowden & Boone, 2007, p. 71). Survival and thriving in a complex context require adaptability. Agility and adaptability can be the difference between the survival and death of a firm (Teece, Peteraf, & Leih, 2016). Put differently, it can be a difference between a Picasso painting and a Kodak image of Yahoo on a Blackberry cellphone.

When facing such dynamism, successful organisations pursue both exploration of new opportunities while exploiting existing capabilities and resource – they are ambidextrous (Ambrosini, Bowman, & Collier, 2009; Gibson & Birkinshaw, 2004; Schilke, Hu, & Helfat, 2018; Makkonen et al., 2014; Teece, Pisano, & Shuen, 1997; Uhl-Bien & Arena, 2018). Organisations do not lead themselves. Ambidextrous organisations are led by ambidextrous leaders deploying dynamic capabilities. Leaders with contextual intelligence and an ability to implement reconfiguration and integration of internal and external competences – enabling both exploration and exploitation at the same time (Kutz, 2008; Osborn & Marion, 2009; Teece et al., 1997; Uhl-Bien & Arena, 2018)

1.2. Research problem

Complexity theory suggests that agents are more adaptable at the edge of chaos that in stable environments (Schneider & Somers, 2006). This suggests that the environment can influence adaptability (de la Sablonnière, 2017; Duncan, 1972; Jansen et al., 2006; Uhl-Bien & Arena, 2018). Actions required for creating stability and intentionally inducing instability will differ (Kachouie, Mavondo, & Sands, 2018; Newman, 2000; Uhl-Bien & Arena, 2018). Capabilities and leadership traits need to take context into account when facilitate adaptability; contextual intelligence is an essential ability (Khanna, 2014; Kutz, 2008; Osborn & Marion, 2009; Snowden & Boone, 2007).

Leadership remains at the core of a firm’s ability to withstand and cope with a dynamic environment (Teece et al., 1997; Uhl-Bien & Arena, 2018) and dramatic social change (de la Sablonnière, 2017). To remain competitive in this increasing complex and dynamic world, organisations and leaders have to adapt novel approaches to leadership, problem solving, and reconfiguration of resources and capabilities. (Makkonen et al., 2014; Teece et al., 1997; Uhl-Bien & Arena, 2018). However, adaptability remains a challenging endeavour for leaders and organisations (Uhl-Bien & Arena, 2018). Environmental dynamism is a key factor affecting leaders and their (Bitencourt et al.,

2020; Duncan, 1972; Jansen et al., 2006). The literature suggests there is still a need to understand how leaders promote adaptability (Uhl-Bien & Arena, 2018).

Ambidexterity offers a way to manage complexity by suggesting that organisations and leaders use exploration and exploitation at the same time (Gibson & Birkinshaw, 2004; Wilms, Winnen, & Lanwehr, 2019). Meaning they must be able to conduct both exploration and exploitation with similar level of priority, effort and commitment. Complexity induces the need for leaders who have cognitive ambidexterity (Meynhardt, Hermann, & Anderer, 2017). However, Meynhardt et al. (2017) suggest that leaders exhibit one dominant character. Some prefer a need for clarity, stability and cognitive closure (hedgehogs like) which is well suited for exploitation (Meynhardt et al., 2017; Uhl-Bien & Arena, 2018). Others can handle ambiguity, new ideas, and are open to changing their worldview like a fox (Meynhardt et al., 2017) which is well suited for exploration (Meynhardt et al., 2017; Uhl-Bien & Arena, 2018). Cognitive ambidexterity is difficult to achieve (Meynhardt et al., 2017). Literature on ambidexterity recommend that exploration and exploitation should be conducted by different people (Gibson & Birkinshaw, 2004).

The leadership mechanism fit for enabling building, reconfiguring and integrating internal and external competencies remains open for research (Schilke et al., 2018). According to Teece et al. (2007), dynamic capabilities provide management with a framework that guides contextual resource allocation; facilitates decision making and the selection between agility based and traditional risk management tools. Dynamic capabilities cannot be implemented without a conducive environment (internal and external) and leadership fit for adaptability (Uhl-Bien & Arena, 2018). It needs leadership strategies that facilitate and coordinate adaptive practices and create conditions that stimulate cognitive ambidexterity (Uhl-Bien & Arena, 2018). However, rigid rule-based hierarchies and bureaucracy, in both private and public sector firms, hinder information flow, and stifle rapid decision making and responses to dynamic changes in the environment (McBride, 2016; Uhl-Bien & Arena, 2018). Wohlgemuth et al. (2019) found that informal control fostered employee participation and had a significant contribution in harnessing dynamic capabilities. Furthermore, they suggest that there was a need to consider using flexible leadership and coordinating mechanism to complement dynamic capabilities. However, when faced with increasing complexity and dynamism, leaders race to habitual command-and-control mode, one way influence and seeking linear predictability (Osborne & Hinson, 2011; Snowden & Boone, 2007; Uhl-Bien & Arena, 2017). Though the dynamic capabilities literature is vast and wide with a leadership facet, there are rich opportunities to research leadership suitable for enabling dynamic capabilities and role of environmental dynamism in creating an enabling condition

(Schilke et al., 2018; Uhl-Bien & Arena, 2018).

1.3. Research purpose

The aim of this research paper is to examine the role environmental dynamism plays as a mediator in the relationship complexity leadership has with dynamic capabilities. Happening within an environmental context, leadership is about influencing, facilitating participation and alignment towards meeting organisational objectives (Uhl-Bien & Arena, 2018). It is important to research and understand leadership and the various contexts where it is enacted. This research paper follows a quantitative research approach in examining this relationship. A quantitative research uses hypotheses to test correlations and intervening effects (Creswell & Creswell, 2018). Hypotheses are testable research questions or idea and intervening construct act as transmitters of effects between constructs. Quantitative research statistically tests hypothesis to measure the correlative relationship between two or more measurable attributes and the intervening effect of a third or more variable (Creswell & Creswell, 2018).

Except for complexity leadership theory papers, the prime focus of academic research on leadership has not been on enabling organisational adaptability; a vast amount of leadership has focused on enabling performance and individual or team adaptability (Uhl-Bien & Arena, 2018). It is important that leadership research change focus towards organisational adaptability, especially in the wake of disruptive effects of COVID-19 (Ritter & Pedersen, 2020; Teo, Lee, & Lim, 2017; Uhl-Bien & Arena, 2018). Dynamic capabilities is key concepts highlighting the difference between operational and dynamic capabilities and role in aiding organisational adaptability. The environment and the extent of dynamism entangle leadership and adaptability.

Using the literature review as a foundation, Figure 1 below illustrations the conceptualisation of the research aim of this research paper. Complexity leadership is the key independent variable and dynamic capabilities is the dependent variable. The intervening variable is environmental dynamism and acts as a transmitter of the effects the independent variable has on the dependent variable (Creswell & Creswell, 2018). This research paper examined whether such as case is true, that environmental dynamism is a mediator between complexity leadership and dynamic capabilities.

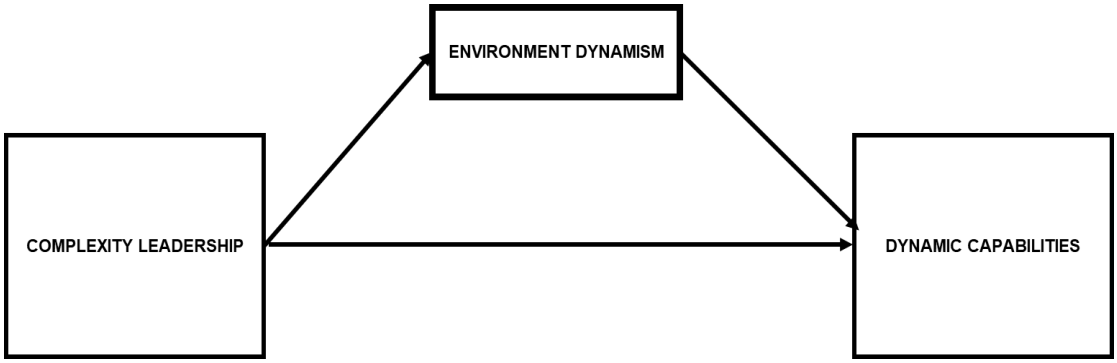

Figure 1 Conceptual model of the research aim

This research paper collected and statistically analyse data with the aim on contributing to scholarly literature and reducing the identified gap by confirming the significance of the relationships and mediation effects.

1.4. Contribution to theory

This research paper aims to contribute to literature on complexity leadership, dynamic capabilities, and environmental dynamism in several ways.

First, it used relatively new measurement scales for both complexity leadership and dynamic capabilities. The complexity leadership scale has been conceptualised as a single factor scale underlined by three subscales (Diesel & Scheepers, 2019). This implies that complexity leadership is higher-order construct reflected by three constructs and explains the correlations between these constructs as a higher-order factor (Brown, 2015). Makkonen et al. (2014) conceptualised dynamic capabilities as a superordinate multidimensional construct (Edwards, 2001). Hair et al. (2019) posit that higher-order constructs should be tested using concepts of a similar level of abstraction. Literature using these two scales to test the mediation effect of environmental dynamism on complexity leadership and dynamic capabilities is rare. For example, Lombard (2018) study on complexity leadership and dynamic capabilities used the sensing, seizing and transforming as higher order capabilities. Dynamic capabilities do not have a standard measure (Schilke, Hu, & Helfat, 2018), this research paper will contribute to literature by using a different measurement scale and further support the growth of research using measurement scales for complexity leadership and dynamic capabilities. This research paper will enrich dynamic capabilities and complexity leadership literature by using a different scale and further enrich the existing findings.

Second, as a response to the call for research into complexity leadership and

adaptability (Uhl-Bien & Arena, 2018), this paper aims to contribute empirically to understanding the correlation between complexity and dynamic capabilities, and the mediating effect of environmental dynamism. Dynamic capabilities allow organisations to renew resources and adapt to dynamic environments – they contribute to organisational adaptability (Uhl-Bien & Arena, 2018). This research paper will thus contribute to understanding leadership for adaptability. Simultaneously, literature on dynamic capabilities and leadership has "untapped potential" (Schilke et al., 2018). This research paper will tap into this potential and contribute to existing literature (Kor & Mesko, 2013; Lombard, 2018). Leadership remains a key antecedent to dynamic capabilities; leadership plays a pivotal role in facilitating, shaping and coordinating organisational practices, resource renewal and reconfiguration. (Schilke et al., 2018; Uhl-Bien & Arena, 2018).

Third, to contribute to literature on complexity leadership as it grows into a matured construct. Dynamic capabilities a matured theory (Edmondson & Mcmanus, 2007) that has well-developed constructs supported by rich research based on diverse settings and contexts (Schilke et al., 2018). In contrast, complexity leadership is in transition between intermediate and matured theory (Edmondson & Mcmanus, 2007) that is open for contribution and growth in areas such as measurement scales and their testing in applied settings; but it has constructs that can be tested using questions and hypothesis (Diesel & Scheepers, 2019).

Forth, to contribute to understanding the mediating role of environmental dynamism in the relationship complexity leadership has with dynamic capabilities. There persists an entanglement between leadership, dynamic capabilities, and the external environment (Uhl-Bien & Arena, 2018). The presence of COVID-19 as a new environmental context has created a unique gap of understanding environmental dynamism in this new setting. The organisation-environmental dynamic interactions remain a key area of interest for scholarly contributions (Schilke et al., 2018). Organisations do not operate in isolation, the external environment in a key variable that can stimulate growth or decline in relative competitive advantage. This research paper will contribute further knowledge on the leadership practice (complexity leadership), dynamic capabilities and role of environmental dynamism.

In its conclusion, this research aims to uncover the untapped potential complexity leadership offers to dynamic capabilities while cognisant of the increasingly unpredictable environmental dynamism, thus it's mediating effect (Diesel & Scheepers, 2019).

1.5. Contribution to business

Adaptability is crucial for the success of business; as crucial as operating results and cashflow (Uhl-Bien & Arena, 2018). The emergence of COID-19 has heightened the need for adaptability. Dynamic capabilities were conceptualised on the notion of a collective set of resources contributing to a firm's survival in a dynamic context (Teece et al., 1997). Leadership in firms will benefit from knowing the influence of complexity leadership on enabling the collective efforts of adapting and thus may adapt its principles combined with dynamic capabilities to the existing suite of strategic responses to the ever-growing complex environmental context. When faced with increasing complexity, leaders can deploy these strategies and exploit the dynamism and see it as an opportunity and not only a crisis creating contexts.

Leadership development in organisations seeks to find novel ways of enabling firms to survive and thrive by training employees and seeking to implement new skills and knowledge into the way the organisation operates. Novel forms of leadership can be a resource that foster adaptability, employee participation (both upper and lower echelons (Hambrick & Mason, 1984) and the appropriate operational and dynamic capabilities (Makkonen et al., 2014). This research paper will assist organisations and graduate business schools in selecting leadership literature and methods to deploy in the quest for fostering organisational leadership, employee participation and leveraging and reconfiguring existing resources (Makkonen et al., 2014).

1.6. Document purpose and structure

This research paper will explore the mediating role of environmental dynamism in the relationship complexity leadership has with dynamic capabilities.

- Literature review and conceptual model
- The research method and design
- The research results
- The discussion of the results
- Conclusion

2. Chapter 2: Literature Review

2.1. Introduction

The modern business environment is characterised by complexity and unpredictability (Osborne & Hinson, 2011); it is creating adaptive challenges for leaders worldwide (Heifetz & Laurie, 2001; Uhl-Bien & Arena, 2017). Complexity leadership asserts that leadership is relational and involves a process that facilities adapting to change, and handling the ambiguity associated with managing in dynamic environment (Clarke, 2013; Uhl-Bien & Arena, 2018). Another source of handling dynamic environment is the dynamic capabilities concept championed by Teece et al. (1997). It advocates for handling dynamism through a firm's ability to build, integrate and reconfigure internal and external competencies (Schilke et al., 2018; Teece et al., 1997). Environment dynamism is the shared context underlying the two concepts.

This section will discuss complexity leadership theory, dynamic capabilities, and environmental dynamism as a way of understanding leadership and capabilities for enabling organisational adaptability given the dynamic and complex context.

2.2. Complexity leadership

Complexity leadership theory is a framework that offers insights on how to create a conducive climate for adaptability (Uhl-Bien & Arena, 2018). It is an alternative leadership model suited for addressing complexity and unpredictability in the internal and external organisational climate. In its core is the notion that leadership is a process whereby individuals interact with each other and through this engagement they achieve adaptive outcomes (Clarke, 2013; Uhl-Bien & Arena, 2018).

2.2.1. Complexity theory

Complexity leadership theory was inspired by complexity theory with a view of organisations as complex adaptive systems with agents interacting and influence each other to achieve novel solutions to complex and dynamic contexts (Clarke, 2013; Uhl-Bien, Marion, & McKelvey, 2007). Complexity is defined as a rich interconnectivity where connected parts impact and change each as they interact (Uhl-Bien & Arena, 2017). Interconnectivity creates a climate that empowers and stimulates the rise of complexity.

As an example, the human brain has around 10^{10} (10 billion) neuronal cells with 10^{14} (100 trillion) interconnections that interact and create unmanageable functionality, adaptiveness, and the emergence of consciousness (Kauffman & Gare, 2015; Kwapień & Drozdz, 2012; Popper, 1966). The brain is viewed as a complex adaptive system capable of more things than the sum of its parts (Kwapień & Drozdz, 2012).

A complex adaptive system is a system with rich, interconnected components, called agents, that learn, change and adapt as they interact with each other and their environment (Marion & Uhl-Bien, 2001; Phillips & Ritala, 2019). The complex adaptive systems view sees agents as active participants in adaptation and co-creators of evolution (Marion & Uhl-Bien, 2001; Schneider & Somers, 2006). Akin to an ecosystem without a central controlling agent, the intertwined actions between resource-integrating individual agents, happening at a micro and meso level, result in a synergetic and irreducibly "emergent" behaviour at a macro-level (Meynhardt et al., 2016; Phillips & Ritala, 2019; Schneider & Somers, 2006). Complexity leadership embraces emergence is an important characteristic of entrepreneurial leadership (Uhl-Bien & Arena, 2018). The key role of leadership in complex adaptive system is creating conditions that foster learning, manage and develop networks, using the networks intelligence, group interactions aligned to global common direction and goals, and emergence of novel solutions & ideas (Marion & Uhl-Bien, 2001; Schneider & Somers, 2006). Leadership is viewed as the actions enacted by individuals irrespective of their position, is shared and lives in the actions conducted, actions beyond rule-compliance (Marion & Uhl-Bien, 2001; Schneider & Somers, 2006).

2.2.2. Complexity leadership theory

Drawn from complexity science, the complexity leadership theory is a framework for leadership in the volatile, interconnected and complex modern era (Uhl-Bien et al., 2007; Uhl-Bien & Arena, 2017). This framework emphases the importance of the adaptive capacity of a complex adaptive system, engaging adaptive pressures and using the interconnected network to take advantage of emergence (Rosenhead et al., 2019; Uhl-Bien & Arena, 2017). According to Uhl-Bien & Arena (2018), complexity leadership has three aspects to leadership: entrepreneurial, enabling and operational as outlined in Figure 2 below. Instead of using a hierarchal structure and process, the three forms of leadership live in various layers of management and present in the informal and formal organisational structure.

Figure 2 Complexity Leadership framework adapted from (Uhl-Bien & Arena, 2018)

Entrepreneurial leadership

Entrepreneurial leadership is associated with exploration and entrepreneurial activities (Uhl-Bien & Arena, 2018). It helps drive novelty, new ways of thinking, innovation, learning, growth and exploration (Gibson & Birkinshaw, 2004; Uhl-Bien & Arena, 2018). The risk associated with this leadership is failure, conflicting and an unsupportive climate when leadership is dominated by rigidity and compliance–orientation (Uhl-Bien & Arena, 2017, 2018). To succeed, entrepreneurial leaders use the network in stimulating emergence while taking advantage of the scalability it provides (Osborn & Marion, 2009).

This leadership role can be likened to the preference for the fox-like way of thinking. A cognitive style associated with ambiguity, new and opposing ideas, and better able to deal with complexity (Meynhardt et al., 2017). From a complex adaptive systems perspective, entrepreneurial leadership is equivalent to destabilising a system and driving it towards the edge of chaos (far-from equilibrium) using pressure, innovation and conflict (Schneider & Somers, 2006; Uhl-Bien & Arena, 2018). Entrepreneurial leadership supports coping with unpredictability and novelty (Uhl-Bien & Arena, 2018).

Operational leadership

The role of operational leadership is aligning entrepreneurial activities with the existing operations, resource allocation, and creating a new emergent order that will align with generating operational results (Uhl-Bien & Arena, 2018). Though innovation and fox-like thinking are essential for adaptability, organisational survival requires activities aligned to generate operational results, efficiencies and creating stability (Uhl-Bien & Arena,

2018). It enables the reintegration of novelty into the operational core business, an enslavement of the new emergent order (Meynhardt, Chandler, & Strathoff, 2016; Uhl-Bien & Arena, 2018).

This leadership role can be likened to the preference for the hedgehog-like way of thinking, a preference for clarity (low ambiguity–cognitive closure) and a universal method of coordinating and doing things (Meynhardt et al., 2017). From a complex adaptive systems perspective, this is equivalent to stabilising a system–creating new order from instability (Schneider & Somers, 2006). A dominant operational leadership results in rigidity equivalent to a highly order systems that have low adaptive capacity and evolutability (Schneider & Somers, 2006). Operational leadership prefers stability and control than emergence (Uhl-Bien & Arena, 2018).

Enabling leadership

Enabling leadership creates a balance in leadership by interfacing the conflicting operational leadership demands for exploitation and exploration pursuits of entrepreneurial leadership (Gibson & Birkinshaw, 2004; Uhl-Bien et al., 2007; Uhl-Bien & Arena, 2018). The conflicting perspectives of operational and entrepreneurial leadership are entangled by enabling leadership that seeks to create an ambidextrous balance (Uhl-Bien & Arena, 2018). Enabling leadership glues together operational and entrepreneurial leadership. Enabling leadership highlights the vital the role of social capital as leadership competence, building bonds within team, across teams and levels of employment (M. J. Arena & Uhl-Bien, 2016; Chen, Zheng, Yang, & Bai, 2016; Dressel, Johansson, Ericsson, & Sandström, 2020; McCallum & O'Connell, 2009; Meng, Clausen, & Borg, 2018).

Humans do not fit into a neat cognitive box. When the situation dictates, we switch between hedgehog-like and fox-like thinking (Meynhardt et al., 2017). Complexity calls for cognitive ambidexterity (Meynhardt et al., 2017) which enabling leadership supports (Uhl-Bien & Arena, 2018). From a complex adaptive system view, enabling leadership enables the cooperation of agents and a climate for the emergence of bottom-up interactions (Schneider & Somers, 2006). It influences variables vital for a systems adaptability: inter-relatedness within a system, common schemata shared by sub-units and inter-relatedness across systems. Enabling leadership helps create a climate that stimulates, encourages, supports and maintains adaptability using adaptive space (Uhl-Bien & Arena, 2017, 2018).

Adaptive Space

Adaptive space refers to conditions created to facilitate engagement between agents in a network/organisation (Uhl-Bien & Arena, 2017, 2018). Adaptive space creates an environment conducive for engaging conflicting demands of operational leadership (exploitation activities) and entrepreneurial leadership (exploration activities), learning, innovation, gathering and sharing intelligence/information and creating a safe space for conflicting and connecting (Uhl-Bien & Arena, 2017, 2018).

Using adaptive space highlights the importance of gathering intelligence, social capital, and employee participation. Adaptive space encourages the development and cultivation of contextual intelligence (C. H. Brown, Gould, & Foster, 2005; M. Kutz, 2008; M. R. Kutz & Bramford-Wade, 2013), discussion and focusing attention on common goals (Marion & Uhl-Bien, 2001; Osborn et al., 2002) and developing networks across the organisation (Marion & Uhl-Bien, 2001; Osborn et al., 2002). Adaptive space facilitates *discovery* of ideas and information, *development* of new knowledge, process, and networks, *diffusion* of ideas and novelty into wider organisation, and *disruption* of the old ways of doing things – the 4D's of adaptive space (Arena & Uhl-Bien, 2019; Uhl-Bien & Arena, 2017, 2018).

In conclusion, complexity leadership theory contributes to organisational adaptability by providing a coordinating mechanism that foster adaptive behaviour.

2.3. Dynamic capabilities

2.3.1. Introduction

Since its inceptions in the early 90s by Teece et al. (1997), dynamic capabilities has gained prominence in organisational studies as a tool that highlights how firms can adapt to dynamic environmental conditions. As a concept of interest, it has spread from strategy (Eisenhardt & Martin, 2000; Teece et al., 1997) to areas such corporate foresight (Schwarz, Rohrbeck, & Wach, 2019; Semke & Tiberius, 2020), marketing (Zou, 2009; Kachouie, Mavondo, & Sands, 2018) and leadership (Pitelis & Wagner, 2019). It emerged from the resource-based view of the firm that advocated for core competencies as a mean through which firms gained a relative competitive advantage (Barney, 1991; Barreto, 2010; Teece et al., 1997).

2.3.2. Resource-based view of the firm

The resource-based view of the firm (Barney, 1991) advocated for a bundle of rare and valuable resource, termed core competences, as a means through which firms gained a competitive advantage (Eisenhardt & Martin, 2000; Teece et al., 1997). At the core of resource-based view is a set of diverse and firm-specific resources such as human capital (expertise), physical assets (i.e., computers, machines), intangible assets (i.e., trade secrets, business model) and organisational capabilities (i.e., leadership, marketing team, business development); they are coordinated and aligned strategically to create value (Barney, 1991; Eisenhardt & Martin, 2000; Teece et al., 1997). Instead of firms searching the market for opportunities to gain a competitive edge, the key to success lied in distinctiveness of the firm's resources and capabilities (Barney, 1991; Eisenhardt & Martin, 2000; Teece et al., 1997). Prahalad & Hamel (2003) argued that the combination of resources and capabilities created a unique and emergent core competence that was not easily replicable. Core competences enabled a firm to gain a competitive advantage if they were valuable, rare, inimitability and organised to capture value (Barney, 1991; Eisenhardt & Martin, 2000; Teece et al., 1997). However, the resource-based view was criticised for being suitable for a stable environment and not fit for a dynamic context (Barreto, 2010; Teece et al., 1997). To gain a competitive advantage in a dynamic environment required dynamic capabilities (Eisenhardt & Martin, 2000; Teece et al., 1997).

2.3.3. Dynamic capabilities

The dynamic capabilities concept was founded on the notion that the resource-based view of the firm was misplaced in dealing with dynamic environments (Barreto, 2010; Eisenhardt & Martin, 2000; Teece et al., 1997). To sustain and gain a competitive advantage in a dynamic environment, firms (through its management) have to reconfigure their resources, capabilities and routines (Eisenhardt & Martin, 2000; Makkonen et al., 2014; Teece et al., 1997). In their conceptual defining article, Teece et al. (1997) defined dynamic capabilities as the firm's capacity and ability to intentionally "integrate, build, and reconfigure internal and external competences to address rapidly changing environments" (p. 516). At the heart of the definition are the four key assumptions: ability, intent, building, and the external environment. These assumptions are outlined below.

First, the ability implies there is a special role organisational processes and resources play in dynamic capabilities (Barreto, 2010; Eisenhardt & Martin, 2000; Schilke

et al., 2018; Teece et al., 1997). A firm's capabilities encompass operational capabilities and dynamic capabilities. Operational capabilities refer to resources deployed towards the day-to-day value-creating activities of the firm (Schilke et al., 2018; Teece et al., 1997). The means through which the firm earns a living. Dynamic capabilities are geared towards change (Ambrosini et al., 2009; Makkonen et al., 2014; Schilke et al., 2018). They are applied on existing resources intending to change them and the firm's ecosystem. Processes and routines are key target areas for implementing change and enabling reliable repeatability of the change activities (Eisenhardt & Martin, 2000; Schilke et al., 2018). Second, intent signals the importance of strategic leadership in purposefully gearing the organisations towards building, extending and changing capabilities (Ambrosini et al., 2009; Schilke et al., 2018; Teece et al., 1997; Wohlgemuth, Wenzel, Berger, & Eisend, 2019). The role of coordinating, reconfiguring, and integrating is largely a leadership activity executed with strategic direction (Barreto, 2010; Makkonen et al., 2014). Wohlgemuth et al. (2019) highlighted the importance of employee participation in routines and actions of modifying and building capabilities. Though managerial cognition was an importance aspect (Helfat & Peteraf, 2015), employee participation highlights the use of the broader human capital resource base & social capital (Rodrigo-Alarcón, García-Villaverde, Ruiz-Ortega, & Parra-Requena, 2018; Wohlgemuth et al., 2019). In addition, intent implies there are voluntary actions and routines enacted to drive the firm towards being fit for survival instead of drafting along at the mercy of environmental dynamism (Makkonen et al., 2014; Wohlgemuth et al., 2019). Third, building implies capabilities are not typically purchased but created (Barreto, 2010). This implies there is path-dependency. The firm's historical past and journey through time creates distinctiveness in the type of capabilities that emerge; though they may be similarities in capabilities, the unique path firms have create distinctiveness in abilities (Eisenhardt & Martin, 2000; Makkonen et al., 2014). Forth, the rapid changes in the external environmental plays are role in dynamic capabilities (Ambrosini et al., 2009; Barreto, 2010; Makkonen et al., 2014; Teece et al., 1997). Some capabilities are geared towards incremental change fit for stable environments and other towards dynamic environments and hypercompetitive contexts (Ambrosini et al., 2009; Makkonen et al., 2014; Newman, 2000).

Several views on dynamic capabilities have contributed to the field and expanded the concept (Schilke et al., 2018).

- Eisenhardt & Martin (2000) highlighted the importance of organisational processes in enabling the creation of resources, reconfiguration of internal resources, and gaining and releasing of resources. Importantly, achieving competitive advantage was because of managerial actions in "using dynamic

capabilities sooner, more astutely, or more fortuitously than the competition to create resource configurations that have that advantage" (Eisenhardt & Martin, 2000, p. 1117).

- Zollo & Winter (2002) emphasised the importance of systemic, collective, learned and stable routines that create the dynamic capability. Routines are regularly conducted activities with relatively fixed steps and expected outcomes.
- Teece (2007) expanded his view to include sensing and shaping threats and opportunities, seizing opportunities, and transforming and reconfiguring resources.
- The importance of internal and external view was emphasised by (Alsos et al., 2008) in their view that dynamic capabilities involved a) external observations and evaluation (monitoring the external environment for new possibilities), b) external resource acquisition (using the external network and stakeholders), c) internal resource reconfiguration (using learning, knowledge integration, employee participation and recombining resources) and d) internal resource renewal (through developing new products, services or strategic direction).

2.3.4. Hierarchies of dynamic capabilities

Several authors have characterised dynamic capabilities as a concept with several dimensions or variations and not a single monolithic construct (Schilke et al., 2018). This means dynamic capabilities has different dimensions and facets that affect resources in varying ways (Schilke et al., 2018). Multidimensionality means a construct is composed of various interrelated constructs that may have distinct characteristics but explain one umbrella construct (Edwards, 2001).

For example, Ambrosini et al. (2009) conceptualised dynamic capabilities with three hierarchies differentiated by the environmental context as outline in Figure 3 below.

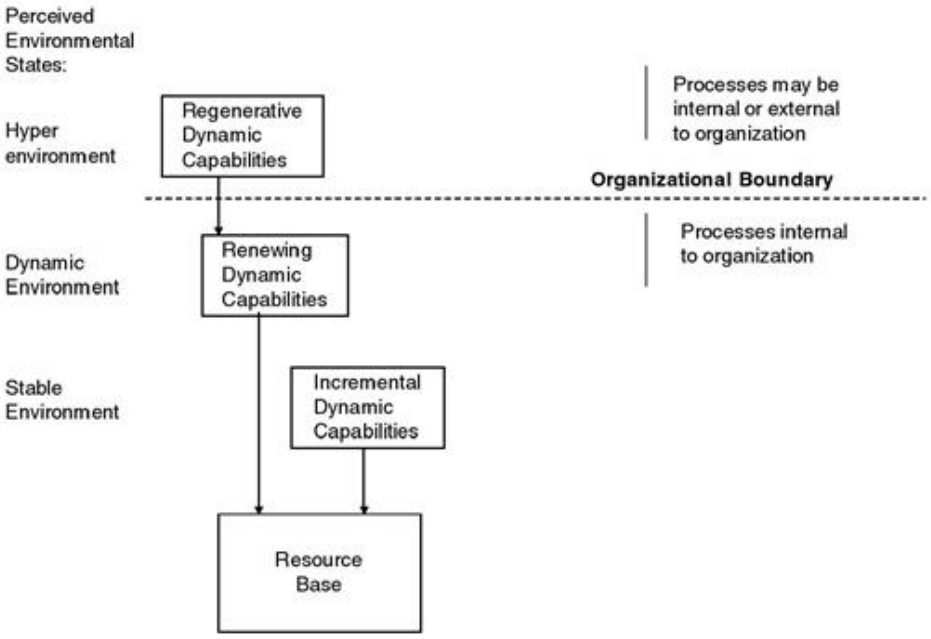

Figure 3 Dynamic capabilities adapted from (Ambrosini et al., 2009)

The three levels are incremental dynamic capabilities suitable for stable environments (change is predictable), renewing dynamic capabilities suitable for a dynamic environment (renew and reconfigure existing resources) and regenerative dynamic capabilities suitable for hyper environments but act on renewing dynamic capabilities aiming to change resources and practices to foster adaptability and improving dynamic capabilities (Ambrosini et al., 2009). This work expanded the research by Winter (2003) that highlighted zero-level capabilities (how a firm earns a living now), first-order (capabilities that changed products and processes) and high-order capabilities (those that respond to competency destroying exogenous shocks).

2.3.5. Renewing and Regenerative Capabilities

Makkonen et al. (2014) adapted and improve the dynamic capabilities scale developed Alsos et al. (2008) to measure dynamic capabilities as a multidimensional superordinate construct with two dimensions, renewing capabilities and regenerative capabilities as outlined in Figure 4 below–adapting the conceptual framework of Ambrosini et al. (2009).

Dimensions		Definition
Regenerative capabilities	Reconfiguration	The capability to continuously and purposefully reconfigure the existing resource base, enabling the firm to transform and exploit its existing knowledge.
	Leveraging	The capability to utilize and deploy an existing resource in new a situation, allowing the firm to replicate an operational capability in a new market.
	Learning	The capability that allows the firm to adopt, acquire and create new capabilities through the learning processes of the organization.
Renewing capabilities	Sensing and seizing	The capability to position oneself favorably in an environment and to explore new opportunities.
	Knowledge Creation	The capability to continuously create and absorb new knowledge, and to develop new products or processes, also known as absorptive capacity.
	Knowledge Integration	The capability to acquire and integrate new knowledge through external sources such as networks, also referring to the utilization of social capital.

Figure 4 Dynamic capabilities adapted from Makkonen et al. (2014, p. 2709)

Renewing dynamic capabilities deploy novel ways of configuring new or existing resources, they refresh the resources (Ambrosini et al., 2009; Makkonen et al., 2014). They are composed of sensing and seizing, knowledge creation and knowledge integration (Makkonen et al., 2014). Regenerative dynamic capabilities change resources and practices to foster adaptability and improving dynamic capabilities. Unlike renewing capabilities, regenerative dynamic capabilities operate on and impact renewing dynamic capabilities (Makkonen et al., 2014). They are composed of learning, leveraging networks and reconfiguration (Makkonen et al., 2014).

In conclusion, dynamic capabilities offer a framework that facilitate adaptability aimed at retaining and gaining a competitive advantage.

2.4. Environmental dynamism

Organisations do not operate isolated from external environment effects. They are influenced by and influence the external environment they operate within (Duncan, 1972; Newman, 2000). A dynamic environment is reflected by unpredictable shifts between stability and instability (Dess & Beard, 1984; Jansen et al., 2006). Instability creates anxiousness and heightens uncertainty. It is the inspiration behind the VUCA worldview that sees the dynamism creating a volatile, uncertain, complex and ambiguous set of

conditions (Bolman & Deal, 2015; Kaivo-oja & Lauraeus, 2018). The inability to predict the way forward makes long-term planning difficult to achieve because of the unclear pattern between cause-and-effect (Dess & Beard, 1984; Jansen et al., 2006; Snowden & Boone, 2007).

Dynamism does not affect organisations only. It may follow a fractal (Longo et al., 2012) like effect with multiple layers affects simultaneously. This means that dynamism can affect individuals, societies, countries and the world. For example, the spread and effects of coronavirus has not only affected business but world, countries, societies, companies and individuals (Crick & Crick, 2020; Krishnamurthy, 2020; Makkonen, Pohjola, Olkkonen, & Koponen, 2014; Ritter & Pedersen, 2020). It has created a dramatic social change (de la Sablonnière, 2017) that has changed routines across multiple layers of society.

Environmental dynamism

Environmental dynamism has been defined as the high rate of change in the external environment and the resulting instability (Dess & Beard, 1984; Jansen et al., 2006). Factors making the environment dynamic include globalisation, ease of information transfer and access, the fast pace of changes in technological, customer's preferences and the high rate of interconnectedness (Osborne & Hinson, 2011; Roberts, 2015). Interconnectedness increases complexity and inter-dependence (Schneider & Somers, 2006).

Dimensions of the external environment are simple-complex and static-dynamic (Dess & Beard, 1984; Duncan, 1972). Simple-complex measures the number of variables considered in decision making; if they are few, it is simple and when they increase it is complex. Complex domains require more cognitive processing and yield greater uncertainties than simplex environments (Dess & Beard, 1984; Snowden & Boone, 2007; Uhl-Bien & Arena, 2017). Static environments exhibit few changes, whereas dynamic environments have frequent changes (Duncan, 1972). The rate of change is one factor, the impact of the change is another factor. Fast and strong changes are more impactful that slow and incremental changes. Highly dynamic environments contribute to higher levels of uncertainty and difficulty in decision making (Dess & Beard, 1984; Jansen et al., 2006; Snowden & Boone, 2007).

Dramatic social change

Dramatic social change offers another view into dynamic environments. Dramatic social

change refers to changes affecting society “witnessed presently across a multitude of contexts from political and economic upheaval, to desperate mass migration, and from natural or human disasters to technological advances” (de la Sablonnière, 2017, p. 2). A notable example is the impact of the novel coronavirus on varies aspects of society. It has affected society at many levels, on a global scale, countries, general society and organisations (Crick & Crick, 2020; Mahaye, 2020; Pantano et al., 2020; Ritter & Pedersen, 2020). The change exhibited fractal like effects (Longo et al., 2012), effects that are similar in multiple layers without statistical differences – lacking discriminant validity (Kachouie, Mavondo, & Sands, 2018). It has led to novel responses to such as lockdowns and curfews, working from home and adapting new routines (Crick & Crick, 2020; Mahaye, 2020; Pantano et al., 2020; Ritter & Pedersen, 2020). It has created instability and uncertainty.

Dramatic social change is characteristic by the pace of change, the rapture in the social structures, rapture in normative structure and cultural identity threat (de la Sablonnière, 2017). In a dramatic social change context, society is affected by the fast pace of change that pushes for new social structures, behaviours, norms, and shares beliefs and values are challenged (de la Sablonnière, 2017). The pace of change refers to the speed of change affecting the collective. Incremental change is slow paced and leads to relatively manageable adaptation, whereas fast change creates a need for renewing skills sets, reconfiguration and new learned behaviour. However, social change within a dramatic context is driven by fast-paced events that change how society functions, threatens normality, routines and cultural practice (de la Sablonnière, 2017).

It is well known that the emergence of COVID-19 (Brüssow, 2020) has created an unimaginable dramatic social change (de la Sablonnière, 2017) that has affected all corners of the world. Dramatic social creates an abnormal state of affairs (de la Sablonnière, 2017). Responding in a stable and unstable environment requires a different approach. Newman (2000) holds a view of first-order change suited for stable environments and second-order change suited for unstable contexts. First-order change is synonymous with incremental change and second-order change aligns with radical, transformative change (Newman, 2000). In responding to COVID-19, second-order change was implemented as it matched the context of a dramatic social change. Countries and organisations adapted new behaviour, working and schooling offsite, adopting new technology as a response. Schools moved to provide blended learning by incorporating online-based learning (Mahaye, 2020), government led countries by responding with lockdowns to prevent the spreading the virus (Crick & Crick, 2020; South African Government, 2020) and organisations adopted novel ways of working, such as working from home and using new technology such as Zoom and Microsoft Teams (Crick

& Crick, 2020). The pandemic increased complexity and induced adaptive responses; it induced the need to consider adopting new routines and capabilities (Jansen et al., 2006; Makkonen et al., 2014; Uhl-Bien & Arena, 2018).

In conclusion, environmental dynamism and dramatic social change offer insight changes in the external environment. Environments that are highly dynamic have high volatility and high uncertainty, whereas the inverse is true for low dynamic environments– the volatility is low and there is relative predictability (Dess & Beard, 1984; Duncan, 1972; Jansen et al., 2006). Diagnosis the appropriate change is important. Stable environments are suited for first-order change and dynamic context are suitable for second-order change (Newman, 2000).

This research paper assumes an open system view, in that the firm interacts with the environment and is influenced and influences the environment. The role of leadership and dynamic capabilities are to lead firm and provide capabilities that supports adaptive efforts to adjust or take advantage of the prevailing environmental conditions.

2.5. The relationship between complexity leadership and dynamic capabilities

Whether a firm survives and thrives is contingent up its ability to adapt and balance the conflicting interest of exploration and exploitation resources (Kachouie et al., 2018; Teece et al., 1997). Leadership and dynamic capabilities are essential for a firm growth and adapting to the changing environment, internally or externally induced (Augier & Teece, 2009; Schilke et al., 2018; Uhl-Bien & Arena, 2018).

As conceptualised by Uhl-Bien & Arena (2017, 2018), complexity leadership has three aspects to leadership: entrepreneurial, enabling, and operational. Entrepreneurial leadership promotes new habits, innovations and explorations while operational leadership promote efficiency, stability and operational excellence. Using adaptive space, enabling leadership facilitates adaptation and exploratory activities and routines which can be associated with entrepreneurial thinking management. In addition, it fosters the development of networks, gathering intelligence, developing social capital, employee participation, focusing attention on what it important and cognitive ambidexterity (M. J. Arena & Uhl-Bien, 2016; Chen et al., 2016; M. Kutz, 2008; McCallum & O'Connell, 2009; Meynhardt et al., 2017; Osborn & Marion, 2009; Uhl-Bien & Arena, 2018). Adaptive space facilitates engaging conflicting that results from the opposing dynamics of operational and entrepreneurial leadership. The adaptive process facilitates the

integration of alternative solutions, processes, new products, services etc. into the operational system as a new order/way of doing things (Uhl-Bien & Arena, 2018).

Dynamic capabilities enable organisational adaptability by promoting adaptation to the changing competitive landscape (Makkonen et al., 2014; Teece et al., 1997). It promotes the ability and intention to create, reconfigure and integration of internal and external capabilities in response to the need for adaptability (Helfat & Peteraf, 2015; Makkonen et al., 2014; Teece et al., 1997; Wohlgemuth et al., 2019). Leadership, employee participation and social capital skills facet to dynamic capabilities; the leadership aspect remains an area fertile for research (Schilke et al., 2018). The intent to build and modify capabilities highlights the importance of managerial cognition and ability, employee participation and social capital (Helfat & Peteraf, 2015; Rodrigo-Alarcón et al., 2018; Wohlgemuth et al., 2019). Augier & Teece (2009) suggest that entrepreneurial thinking managers are essential for implementing dynamic capabilities within organisations. They further suggest the difference entrepreneur and manager is fading (Augier & Teece, 2009).

The current dynamic environment requires leadership with an entrepreneurial flair that can facilitate building and modifying dynamic capabilities (Augier & Teece, 2009; Helfat & Peteraf, 2015; Wohlgemuth et al., 2019). Complexity leadership offers a trait leadership the facilitates exploration and exploitation of resources and capabilities (Uhl-Bien & Arena, 2018). As an antecedent to dynamic capabilities, leadership that facilities adaptability is crucial to the process and ability of a firm to build, integration and reconfigure capabilities (Augier & Teece, 2009; Schilke et al., 2018; Uhl-Bien & Arena, 2018). Both dynamic capabilities and complexity leadership highlight social capital, employee participation, and managerial cognitions as windows to promoting adaptability (Arena & Uhl-Bien, 2016; Chen et al., 2016; Helfat & Peteraf, 2015; Rodrigo-Alarcón et al., 2018; Uhl-Bien & Arena, 2018; Wohlgemuth et al., 2019). Literature suggests that complexity leadership and dynamic capabilities have a positive correlation.

2.6. The relationship between complexity leadership and environmental dynamism

Complexity theory suggests leadership acts differently when an organisation is on the edge of chaos than when the environment is stable (Schneider & Somers, 2006). This suggests that the environment influences leadership behaviour. Leadership does not happen in isolation to external effects; it is enacted in stable and dynamic contexts (Uhl-Bien & Arena, 2017, 2018).

Dynamic environments are unpredictable; they create uncertainty and a need for adaptability (Jansen et al., 2006; Uhl-Bien & Arena, 2018). Dynamism creates environmental shifts that transition back and forth between stability and instability, minor and major changes; in such environments, it is difficult to predict the future and make long-term plans (Duncan, 1972; Jansen et al., 2006; Uhl-Bien & Arena, 2018). Stable environments are characterised by predictability and an ability to match causal effects of actions, whereas in dynamic environments there are unpredictable outcomes. Diagnosing the context accurately is important as it affects decision making and implementations. Mismatching of the context and response can create challenges for firms and leaders (de la Sablonnière, 2017; Duncan, 1972; Snowden & Boone, 2007; Uhl-Bien & Arena, 2017).

When faced with a dynamic environment, effective leaders simultaneously seek stability and novelty, exploration and exploitation, they are ambidextrous (Gibson & Birkinshaw, 2004; Uhl-Bien & Arena, 2018). Complexity leadership offers three-sphere leadership for enabling adaptability (Uhl-Bien & Arena, 2018). Operational leadership focuses on seeking stability, performance outcomes, and ensuring operational efficiencies (Uhl-Bien & Arena, 2018). Entrepreneurial leadership seeks idea generation, new products and services, experimentation, and alternative ways of conducting business and processes (Uhl-Bien & Arena, 2018). Enabling leadership enables adaptability by using adaptive space and process to manage conflicting demands of exploration and exploitations. Complexity leadership offers a means to achieving ambidextrous leadership (Uhl-Bien & Arena, 2018).

Leaders in organisations facing dynamic environments have to make trade-offs between conflicting demands of exploration and exploitation. Pursing both exploration and exploitation at the same time creates tensions and the need to balance resource allocation and organisational priorities (Gibson & Birkinshaw, 2004; Jansen et al., 2006; Uhl-Bien & Arena, 2018). Complexity leadership offers leadership for adaptability and dealing with the tension created by offering three entangled leadership traits.

Literature suggests that in a dynamic environment, complexity leadership is well suited for leading organisation successfully (Dess & Beard, 1984; Duncan, 1972; Uhl-Bien & Arena, 2018). Leading organisational adaptability requires leader who positions people and the organisation towards adaptive activities (Uhl-Bien & Arena, 2018). As an example, Osborn et al. (2011) argue that when faced with increasing complexity (dynamism), leadership should move to multi-directional influence, collective intelligence, building network connection. These are typical traits of complexity

leadership (Osborne & Hinson, 2011; Uhl-Bien & Arena, 2018) that takes advantage of networks, collective intelligence and focused attention (Kutz, 2008; Osborn et al., 2002). As a result, the literature suggests that complexity leadership and environmental dynamism should have a positive correlation. An increase in environmental dynamism should increase complexity leadership.

2.7. The relationship between environmental dynamism and dynamic capabilities

Environmental dynamism affects how firms operation and the need for adaptation in response to environmental dynamism (Kachouie et al., 2018). In an open-systems view, organisations are influenced by the environment and context specific factors (Johns, 2006; Makkonen et al., 2014). Dynamic environments induce complexity (Duncan, 1972; Jansen et al., 2006). Complexity refers to increasing number and interconnectedness of variables firms have to manage (Schneider & Somers, 2006; Uhl-Bien & Arena, 2017). In response to increasing external complexity, firms have to increase their internal complexity to match the external context (A. Schneider, Wickert, & Marti, 2017; M. Schneider & Somers, 2006). Environment plays a role in how firms operate and may influence the ability to survive and thrive.

Literature on dynamic capabilities emphasis that firms have to realign, renew and reconfigure resources in response to changing environmental conditions (Ambrosini et al., 2009; Makkonen et al., 2014; Teece et al., 1997). In a dynamic environment, the ability to adapt, innovate and agility can make or break an organisation (Teece et al., 2016). Whereas operational resource facilitates efficiency and operational excellence, dynamic capabilities facilitate renewing and reconfiguration of existing resources to match and responded to external environment's dynamism (Ambrosini et al., 2009; Makkonen et al., 2014; Teece et al., 1997). Environmental dynamism is considered an important antecedent to dynamic capabilities (Bitencourt et al., 2020; Schilke et al., 2018). Organisations have to build the capabilities to respond to external and internal changes and to induce market changes (Kachouie, Mavondo, & Sands, 2018). Dynamic capabilities can enable firms to induce or cope with dynamism (Ambrosini et al., 2009; Kachouie et al., 2018; Makkonen et al., 2014; Teece et al., 1997).

As a response to the increasing external complexities, firms increase their internal complexity by changing routines, processes, recruiting new resources, outsourcing services, reconfiguration of services, products and structural assets (Eisenhardt & Martin, 2000; Makkonen et al., 2014; Teece et al., 1997). For example,

organisation use collaborations, forming alliances or outsourcing services to cope with external demands (customers, responding to competing etc.) and increase capabilities (Eisenhardt & Martin, 2000; Teece et al., 1997). In stable environments, incremental dynamic capabilities are deployed to manage the predictable external environmental effects from a slow rate of change (Ambrosini et al., 2009). As an example, Newman, (2000) describes first-order change as suited for stable environments and conducted incrementally whereas second-order change occurs quickly and may affect and transform the core of an organisation.

Literature suggests there is a positive relationship between environmental dynamism and dynamic capabilities; environmental dynamism can serve as an antecedent to dynamic capabilities (Schilke et al., 2018). Makkonen et al. (2014) found that the effectiveness of different dynamic capabilities was contingent on the competitive environment. In a stable environment, incremental dynamic capabilities are suitable whereas renewing and regenerative suitable for dynamic and hypercompetitive environments (Ambrosini et al., 2009; Makkonen et al., 2014; Newman, 2000). Environmental dynamism is an important antecedent to dynamic capabilities (Schilke et al., 2018).

2.8. The mediating role of environmental dynamism in the relationship between complexity leadership and dynamic capabilities

Adaptability is more likely to happen at the edge of chaos than in stable environments (Schneider & Somers, 2006). Environmental dynamism and increasing complexity are foundational contexts for complexity leadership and dynamic capabilities (Makkonen et al., 2014; Teece et al., 1997; Uhl-Bien & Arena, 2018). In stable environments change is incremental (first order change) and in unstable environments is more risky and has wider effects (second-order change) needing appropriate process management (Newman, 2000).

Firms facing dynamic environments have to adapt and increase internal complexity to match the increase in external complexity (M. Schneider & Somers, 2006). In its definition, “dynamic capabilities are a firm’s ability to integrate, build and reconfigure internal and external competencies to address rapidly changing environments” (Teece et al., 1997, p. 516). Competency renewal includes outsourcing competencies, adapting new routines and best practice, improve organisational and individual learning and

reconfiguration of resources such as mergers of business units and companies, bundling of services and products (Makkonen et al., 2014; Teece et al., 1997).

Adaptation to dynamic environments requires an ambidextrous approach that facilitate both exploration of new routines and opportunities while exploitation existing competencies and pursuing performance targets (Gibson & Birkinshaw, 2004). Complexity leadership achieved this using entrepreneurial leaders for innovation, learning and generating novel outcome, while operational leadership focuses on performance outcomes, quality assurance and systematically creating stability (Diesel & Scheepers, 2019; Jansen et al., 2006; Makkonen et al., 2014). As conflict arise because of the two opposing approaches, complexity leadership offers adaptive space as a set of environmental conditions that stimulate communication, collaboration, engaging conflict and seeking new solutions that can be incorporated into the organisational way of doing things – the operational system (Uhl-Bien & Arena, 2018).

As a shared context, environmental dynamism induces complexity leadership and dynamic capabilities approaches to seeking solutions and means through which an organisation can achieve adaptability. Leadership plays a key role in facilitating adaptation alongside organisational resources and capabilities. They represent a unique combination that can differentiate firms between those that remain competitive and those that collapse under the pressure of the external environment (Makkonen et al., 2014; Teece et al., 1997; Uhl-Bien & Arena, 2018). Literature review suggests that environmental dynamism mediate the relationship between complexity leadership and dynamic capabilities.

2.9. Conclusion

The literature review has highlighted the need for organisational adaptability. Organisations facing dynamic environments have to make trade-offs between conflicting demands for exploration and exploitation. Complexity leadership offers insight into way leaders can help their organisation adaptability by offering a three leadership forms (entrepreneurial, enabling, and operational) and the use of adaptive space (Uhl-Bien & Arena, 2018). Dynamic capabilities offer a framework that facilitate adaptability aimed at retaining and gaining a competitive advantage. Renewing capabilities and regenerative capabilities offer insights into creating and exploiting capabilities that are dynamic.

3. Chapter 3: Conceptual model and hypotheses

3.1. The conceptual model and framework

The aims of this research paper is to contribute to literature on understanding the mediating effect of environmental dynamism on complexity leadership and dynamic capabilities. Complexity leadership and dynamic capabilities are both second-order construct. The literature review has shown there is a gap deepening the understanding of the relationship complexity leadership has with dynamic capabilities and the mediating role of environmental dynamism between them.

Using existing theory, a conceptual framework enables the derivation of a theoretical framework that can predict relationships between concepts and give a basis on which the findings are validated (Creswell & Creswell, 2018). It provides the nature of the relationship between concepts. The conceptual framework is depicted in Figure 4 and Figure 5 the theoretical framework with the relationships and direction of testing shown by the arrowheads.

Figure 5 below depicts the conceptual framework. The framework, read from left to right, illustrates how the variables relate to each other. This means that it shows how the left side related to the right side (Creswell & Creswell, 2018). Complexity leadership is an independent variable and dynamic capabilities is a dependent variable (objective 1). Environmental dynamism is a dependent variable when tested with complexity leadership (objective 2) and an independent variable when testing the relationship with dynamic capabilities (objective 3). In addition, environmental dynamism is acting as a mediation in the relationship complexity leadership has with dynamic capabilities (objective 4).

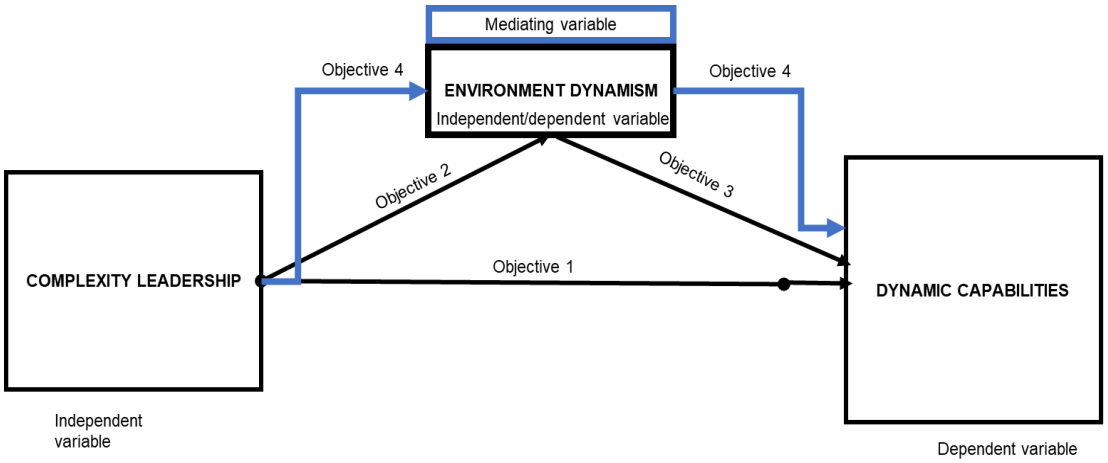

Figure 5 Conceptual framework

3.2. Hypothesis

The theoretical framework provides guidance and direction to the research design and method (Creswell & Creswell, 2018). The theoretical framework for this research paper is outlined in Figure 6 below; it shows the hypothesis of the research paper. It shows the statistical relationship tested and is read from left to right. A quantitative study research uses hypothesis to describe the characters and relationship between variables (Creswell & Creswell, 2018). According to Creswell & Creswell (2018), hypotheses are research questions that can be tested using statistical methods. The left side of the theoretical framework shows the independent variables with the one-headed arrows indicator the relationship between the two variables. For this research paper, complexity leadership is the independent variable and dynamic capabilities is the dependent variable (H1). Environmental dynamism is a dependent variable in its relationship with complexity leadership (H2) but an independent variable in its relationship with dynamic capabilities (H3). Environmental dynamism is a mediator between complexity leadership and dynamic capabilities as shown in H4.

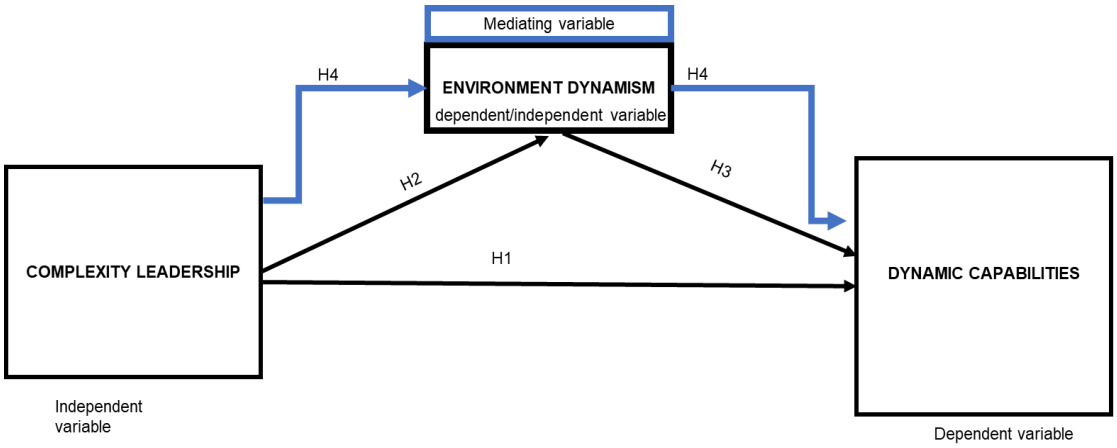

Figure 6 Theoretical framework

Objective 1: To determine if there is a positive relationship between complexity leadership and dynamic capabilities.

$H_0$1: There is no positive relationship between complexity leadership and dynamic capabilities.

$H_1$1: There is a positive linear relationship between complexity leadership and dynamic capabilities.

Objective 2: To determine if there is a positive relationship between complexity leadership and environmental dynamism.

$H_0$2: There is no relationship between complexity leadership and environmental dynamism.
$H_1$2: There is no relationship between complexity leadership and environmental dynamism.

Objective 3: To determine if there is a positive relationship between environmental dynamism and dynamic capabilities.

$H_0$3: There is no positive relationship between environmental dynamism and renewing capabilities.
$H_1$3: There is a positive linear relationship between environmental dynamism and renewing capabilities.

Objective 4: To determine if environmental dynamism mediates the relationship between complexity leadership and the dynamic capabilities

$H_0$4: Environmental dynamism does not mediate the relationship between complexity leadership and dynamic capabilities.
$H_1$4: Environmental dynamism mediates the relationship between complexity leadership and dynamic capabilities.

4. Chapter 4: Research method and design

4.1. Introduction

The literature review supplied a foundation for the hypothesis in chapter 3 used to develop the research method and design. It suggests there is a relationship between complexity leadership and dynamic capabilities and environmental dynamism mediates the relationship between these two constructs.

This chapter provides the method used to test the hypothesis developed from the literature review. The chapter discusses the research design, the method of collecting data, and the statistical methods used for analysing this data.

4.2. Research design and method

This research paper followed a quantitative research method. A quantitative research approach allows a researcher to collect data and make statistically analysis of relationship between variables (Creswell & Creswell, 2018). The aim of this research paper was to test whether the relationship between complexity leadership and dynamic capabilities was mediated by environmental dynamism. Given this objective, a quantitative approach was deemed approach to meet the objectives set out as it allows of testing correlative relationships between constructs (Creswell & Creswell, 2018). The research paper was conducted using deductive reasoning. A deductive approach based on existing theories to develop hypotheses and seeks to make a generalised view by testing the data and making conclusions about the hypothesis (Creswell & Creswell, 2018).

Philosophical view

The researcher conducted this research paper with a pragmatic philosophical worldview. A research philosophy is a perspective taken by the researcher in approaching the paper (Creswell & Creswell, 2018). A pragmatic worldview emphasises the importance of adapting a philosophical view guided by the research hypothesis and objective as opposed to the viewing the world with a fixed rule-based lens of post-positivism (Creswell & Creswell, 2018). A pragmatic philosophy approaches research with the practicality of research as the chief priority. This research followed what is possible and what practically works, given the COVID-19 pandemic induced constraints – social distancing, lockdowns, etc.

Data collection method

For this research, an online survey was used to collect data. A self-administered online survey instrument was sent to potential respondents, and the data was electronically collected (Creswell & Creswell, 2018). Using this method creates a standardised and synchronised way of collecting a large volume of data. Respondents can provide information that is in comparable format and makes statistical analysis easier. With COVID-19 restrictions and social distances in place, a face to face administered questionnaire was not practical. This was one method was used to collect the data. The selected mono-method approach allowed for collection of data to make comparative analysis and explain the relationship between construct studied. Though a mix method approach that incorporates both qualitative and quantitative methods would yield more depth (Creswell & Creswell, 2018), it was not pursed because it was not practical given the time constraints.

Time horizon

The research paper followed a cross-sectional approach to collecting data (Creswell & Creswell, 2018). Data was collected over a single point in time, between October and December 2020. It did not follow a longitudinal approach that collects data multiple times from the same respondents and creating two different datasets (Creswell & Creswell, 2018). Longitudinal studies take time and may be costly; they are suitable for measuring changes in relationships between constructs. This research paper was not seeking to study a change in the relationship between constructs over a period, making a longitudinal approach inappropriate (Creswell & Creswell, 2018). A cross-section approach was appropriate and thus selected.

Population and unit of analysis

In a research context, the full dataset of the subjects or individuals the research can extract information from is called a population (Creswell & Creswell, 2018). For this research, the population was all employed people in South Africa. This research paper was aiming to target individuals sharing this common characteristic (Creswell & Creswell, 2018). These group was chosen because they are a diverse group that have unique experiences about leadership, environmental dynamism and dynamic capabilities. Meaning they would provide the research with enriching and diverse views. The aimed of the research paper was to make a generalised view about the chosen constructs and not targeting views from a restrict group in society, as it would create a biased view and introduce common method effect to the research paper. To reduce the method effect

(Brown, 2015; Podsakoff, MacKenzie, Lee, & Podsakoff, 2003) and collate broader beliefs about constructs of interest, the population and sample for this research paper were all working employees in South Africa.

The unit of analysis outlines the subjects of interest for the research paper, the group or individuals that provide the insights to the research paper (Creswell & Creswell, 2018). The unit of analysis for this research paper was the answers received from the participants.

Sampling method and size

Getting insight from all working people in South Africa was an impossible task to achieve. The solution was to select a subset of individuals that can represent this group (Creswell & Creswell, 2018). A large sample size is ideal for a quantitative research paper because it helps to yield superior inferences and represent the research population better than a smaller sample (Hair et al., 2019). Surveys can have low participation rates and survey dropout were respondents leave the survey before responding to all questions (Bell, Bryman, & Harley, 2019; Saunders et al., 2016). Cautiously, the researcher assumed a risk averse scenario with a 50% non-response rate and missing data. The research paper targeted 500 to 1000 responses, without an upper range limit but taking time constraint into account. The aim was to yield a sample range of 250 to 500 valid samples, which is a recommended for conducting a covariance-based structural equation model analysis (Hair et al., 2019). A higher sample size increases the robustness of a research study (Hair et al., 2019).

To achieve a high sample size, this research paper used a two-fold sampling method; a non-probability convenience sampling method followed by snowball sampling to increase the sample size (Bell et al., 2019; Bryman & Bell, 2011). The first strategy was convenience sampling and involved sending the survey to direct contacts at work, using social media tools and websites. The second was snowballing strategy used to increase the number of samples by asking respondents to forward, share and like social media posts that had links to the survey. The researcher used snowballing to increase the sample size.

4.3. Measurement instrument

The questionnaire in the research paper had sections for the respondents' consent, biographical information, complexity leadership, dynamic capabilities and environmental

dynamism. Respondents were asked to provide a rating on each of the key constructs and biographical variable in the measurement instrument. The questionnaire was coded numerically and use a five-point Likert scale for rating complexity leadership, and a seven-point Likert scale for measuring dynamic capabilities and environmental dynamism. Likert scales (Likert, 1932) measure positive or negative responses to a question or statement using a metric measure that ranges from 1 to 5 for the five-point scale (never to always) and 1 to 7 for the seven-point scale (strongly disagree to strongly agree); the anchor points on the scale as deemed to measure the construct in question (Creswell & Creswell, 2018). According to Rindfleisch et al. (2008), using two or more different type of scales for rating the independent variable and the dependent variable can help reduce common method variance bias. This research paper uses two different scales and anchor points to reduce the risk of a common method variance.

4.3.1. Survey design & pilot testing

The survey design ensured the respondents answer all questions before proceeding to the next question. The aim of the design was to minimise non-response bias and missing data (Brown, 2015). General information about the respondents was collected and reported as an aggregate and not singling out specific individuals. A pilot questionnaire was sent out to test the instrument; the pilot served as a quality assurance and provided an opportunity to improve shortcomings. The survey was sent out to six employees for pilot testing.

4.3.2. Data storage

Data collected for the research was stored and is available on request as per the university's guidelines of a 10-year period. The data is stored to ensure it is safe and accessible. The data was stored in a hard drive on a computer and backed up on Microsoft one drive and a Google drive accounts; they provide online storage.

4.3.3. Ethical considerations: participation consent

Data collection begun after the researcher had received ethical clearance. It is important for researchers to protect the rights of participants, privacy and confidentiality while guarding against improper conduct that may reflect negatively against GIBS. It enhances the credibility and authenticity of the research data collection and the results (Creswell & Creswell, 2018). Participants were asked to give informed consent before starting the

survey. In addition, respondents were informed that their participation in this research was voluntary (Creswell & Creswell, 2018).

4.3.4. Biographical Information

Descriptive statistics summarised the information collected. The summarised information included the biographical and organisational demographic data, it described the characteristics of participants and where they worked. This information provides a simple overview of the data, giving no causal relationships between the data. Biographical information described information about participants; it included age, gender, race, level of education, period and level of employment at the organisation. Firm specific descriptive statistics included the firm's industry, age, primary business activity, latest revenue and whether the firm was viewed as bureaucratic or entrepreneurial.

4.3.5. Operationalisation of the Constructs

The rest of the questionnaire focused on measuring the constructs of interest. Constructs are as mental creation, they are not independent items defined by one distinct attribute nor easy to measure using a single metric (Hair et al., 2019). Stated differently, constructs (concepts) are measured by observed variables. Valid measurement of constructs comprising two or more observed variables; observed variables are measurable items in a question (Hair et al., 2019). These measurable questions sometime referred to as items are synonymously called indicators, observed variables, measured variables, questions on a scale whereas constructs are also called factor, concepts, latent variables, composite, component, unobserved variable and so on (Hair et al., 2019; Svensson, 2015).

Constructs are operationalised based on the underlying assumptions about the causal relationship with the observed variables. Reflective measurement model assumes constructs are reflected by observed variables, whereas formative measurement model assumes that observed variables form the construct (Christophersen & Konradt, 2012; Hair et al., 2019). Complexity leadership, dynamic capabilities and environmental dynamism are reflectively measured by the various observed variables; they follow a reflect measurement regime. Observed variables in a reflective measurement scales can be dropped and the construct can still be adequately measured (Brown, 2015; Hair et al., 2019).

4.3.6. Complexity leadership

Complexity leadership was operationalised using a 19 item measurement scale from Diesel & Scheepers (2019), it does not have a generic measurement scale. The scale reflects patterning of attention (PA), developing networks (DN), and contextual intelligence (CI). Each of the subscale measured constructs used to reflect complexity leadership. This makes complexity leadership a second-order construct (Brown, 2015; Hair et al., 2019).

- **Patterning of attention**: Osborn et al.; Osborn & Marion (2002; 2009) developed a 6 item scale to reflect how leaders pattern attention. Patterning of attention is a collective set of activities undertaken by leaders who guide and create focused attention on what is important (Osborn et al., 2002). Focusing on a common priority aligns team members. Patterning attention is reflected in what is communicated, the contents of the discussions and encouraging information exchange and learning (Osborn & Marion, 2009). This creates conditions synonymous with adaptive space (Uhl-Bien & Arena, 2018). It facilitates interaction that can lead to bottom-up emergence of knowledge, innovation, and adaptive responses (Uhl-Bien & Arena, 2017, 2018). Patterning attention aligns with complexity leadership because it creates an environment conductive for adaptive space, engaging tough questions and encouraging constructive conflicting, seeking novel resolutions, and injecting energy into the organisation (Osborne & Hinson, 2011; Uhl-Bien & Arena, 2018). It promotes the transfer of information inside the organisation, contributes to reducing solo's and increasing complexity inside the organisation to match the complexity of the external environment (Marion & Uhl-Bien, 2001; Osborne & Hinson, 2011; A. Schneider, Wickert, & Marti, 2017; Uhl-Bien & Arena, 2017).

- **Developing networks**: Encouraging information exchange and learning creates a fertile ground for developing networks (Osborn & Marion, 2009). Leaders who pattern attention set up a context fertile for developing transfer of knowledge and intelligence. Knowledge exchange cannot be conscripted, it is volunteered (Snowden, 2005). Osborn & Marion (2009) developed a 6 item scale that measures how leaders develop networks. Networks facilitate information flow across the organisational and helps overcome the bureaucratic hierarchies that stifle information flow (McBride, 2016; Uhl-Bien & Arena, 2018). Networks enable leaders to transfer objectives into the organisational system and create alignment between agents in the network (Snowden, 2005; Uhl-Bien & Arena, 2017). Developing networks involves embracing diversity, creating linkages inside and

outside the organisation and building connections across silos and work boundaries (Osborn & Marion, 2009; Uhl-Bien & Arena, 2018). Networks facilitate collaboration both formally and informally, they open up opportunities for amplifying the adaptive process (Uhl-Bien & Arena, 2018). This is consistent with traits of complexity leadership that advocate for developing and using networks to create conditions for emergence and movement of ideas and information across the organisation (Uhl-Bien & Arena, 2017, 2018). Enabling leadership stimulates conditions for adaptive space by using collaboration, creating a structure for information transfer and network cohesion (Uhl-Bien & Arena, 2018).

- **Contextual intelligence**: Leadership happens within a context that has a past and future ahead. Context refers to background and surrounding factors that inform a situation or phenomenon (Johns, 2006). The context where leadership is enacted constraints and influences decision making and options available for charting a path forward (Osborn & Marion, 2009). According to Kutz (2008), contextual intelligence is shown by the ability to classify multiple contextual factors affecting a situation and proactively adapting to the prevailing conditions. The increasing complexity and volume of factors that leaders need to consider in decision making makes diagnosing the context correctly crucial. Leaders need to consider global omnibus context and local discrete contexts (Johns, 2006; Oc, 2018). Contextual intelligence is reflected by actions and attitude that facilitates adaptive behaviour. Complexity leadership advocate for adaptive leadership that considers the increasing complexity and dynamic contexts (Uhl-Bien & Arena, 2017, 2018). Adaptive space cultivates contextual awareness.

Collectively, patterning attention, developing network and contextual intelligence are sub-constructs used as reflective measures of complexity leadership (Diesel & Scheepers, 2019). Complexity leadership is a second-order construct that is not measured directly, it is measured with these three subconstructs and their indicators.

4.3.7. Dynamic capabilities

Dynamic capabilities does not one generic measurement scale. This research paper used the measurement scale developed by Makkonen et al. (2014). The scale was developed to showcase two dimensions of dynamic capabilities, renewing capabilities and regenerative capabilities (Makkonen et al., 2014). Ambrosini et al. (2009) distinguished renewing capabilities that modify the existing resource base and regenerative capabilities that promote creating a new path and facilitate long-term

organisational change by acting upon resources through renewing capabilities. Dynamic capabilities is a superordinate multidimensional construct (Makkonen et al., 2014).

Makkonen et al. (2014) developed a 21 items scale that measures dynamic capabilities. The scale measured sensing and seizing (OBS), knowledge creation (RENRD), knowledge integration (ACQNW), reconfiguration routines (RECRUT), leveraging (RENEMP), and learning (RECEMP). Though observed variables represent two dimensions of dynamic capabilities, as outlined in Appendix 1, the study focused on the main construct and not the dimensions.

4.3.8. Environmental dynamism

Environmental dynamism is a central theme in complexity leadership and dynamic capabilities (Jansen et al., 2006; Uhl-Bien & Arena, 2017, 2018) and denotes the rate of changes in the environment (Duncan, 1972; Jansen et al., 2006). In measuring environmental turbulence, Jansen et al. (2006) created a five-item measurement scale to measure environmental dynamism. It measures changes in the organisational context, client's demands and changes in products and service demands (Jansen et al., 2006).

4.4. Data analysis

4.4.1. Introduction

The section will discuss the data analysis conducted by the researcher. The data analytical process will start with data preparation and editing and cover the descriptive statistics, exploratory and confirmatory factor analysis before using the covariance-based structural equation model (CB-SEM). Table 4 summaries the preliminary data analysis steps to be followed.

4.4.2. Data preparation, editing and

The research conducted data analysis as outlined in the table 1 below. The data collected was screened, reviewed for missing data, errors, outliers, multivariate data assumptions of normality. The design of the questionnaire prevented respondents from skipping questions in a section, this prevent missing data due to avoid some questions in the middle of the survey.

Table 1 Preliminary data analysis steps

Analysis process	Method & Analysis	Rational
Data Preparation		
Data editing	Observing missing data Coding of constructs and survey items Mahalanobis distance.	Resolve missing data, creating a naming conversion and remove outliers.
Normality test	Kurtosis Skewness	To confirm if data is normally distributed.
Reverse worded question	Reverse questions rating on SPSS	To match and align with positively worded questions in the study.
Descriptive Statistics		
Descriptive Statistics	Frequency Percentage Stats	To explain sampled biographical

The survey was designed and distributed using Qualtrics. The initial data analysis was conducted in SPSS. The researcher screened and cleaned the data before starting the analysis. Data screening and cleaning included confirming the number of responses received, addressing missing data, completeness of the responses, coding the questions using the labels outlined in Table 2 and ensuring errors are reduced before analysis.

Table 2 naming and coding conventions

Higher-order constructs		Lower-order constructs	
Acronym	Name	Acronym	Name
Complexity	Complexity leadership	PA	Patterning attention
		DN	Developing networks
		CI	Contextual Intelligence
DC	Dynamic capabilities	OBS	Sensing and seizing
		RENRD	Knowledge creation
		ACQNW	Knowledge Integration
		RECRUT	Reconfiguration routines
		RENEMP	Leveraging
		RECEMP	Learning
ED	Environmental dynamism		

Multivariate outliers were detected by using the Mahalanobis (D^2). Outliers are

observations (indicators) that lie outside the general distribution in the dataset; they lie in extreme ends of the general distribution (Brown, 2015; Hair et al., 2019). Outliers can cause non-normality, inaccurate indicator loadings such as negative loading or loadings exceeding 1 called Heywood cases (Hair et al., 2019). This study used the more conservative 0.001 significant level as the threshold (Hair et al., 2019).

Normality was tested using kurtosis and skewness. In a normal distribution, clusters of variables are centred in the middle instead of the outskirts; the dataset creates a bell like shape (Hair et al., 2019). Skewness measures the height of the normal distribution, and kurtosis measures the flatness or peakedness (Brown, 2015). A dataset is normally distributed when the skewness ranges between -2.58 and +2.58 for a 0.01 level of significance and -1.96 and -1.96 for a 0.05 level of significance (Hair et al., 2019).

Reverse worded items in the questionnaire pose a threat to reliability and thus should be recoded to match the positively worded questions in the questionnaire. One question in the survey was negatively worded. The question measured environmental dynamism, asking “In a year, nothing has changed in our market” had strongly disagree meaning a positive response (meaning there were changes in the market) and strongly agree meaning a negative response (meaning nothing had changed). This item was recoded before data analysis. The responses where reverse turning strongly disagree to strongly agree, and vice versa.

4.4.3. Descriptive statistics

Descriptive statistics summarise the data. The data can be described in a simplified and compressed form to provide noncausal insights using descriptive statistics. It is a generic term used to describe statistical information describing the data (Hair et al., 2019). Descriptive statistics may include the number of samples, mean, variance, standard deviation, range of scoring and other data type such as an age, gender and other similar measures (Creswell & Creswell, 2018; Hair et al., 2019).

4.5. Exploratory Factor analysis

Exploratory factor analysis (EFA) reveals underlying structures in a dataset. EFA is a data driven analytical process that finds relationships (correlations) between observed variables (survey responses) and extracts groups based on commonalities, known as component or factors (Hair et al., 2019). The extent to which observed variables load on a factor is measured using factor loadings; these are equivalent to standardised

regression weights or coefficients (Hair et al., 2019). The higher the factor loadings an observed variable has, the greater it contributed to the respective factor. Thus, an EFA reduces an enormous set of observed variables into factors that can be used for multivariate statistical analysis; the reduced factors should adequately represent the observed variables (Hair et al., 2019). The procedure followed is outlined in Table 3 below

Table 3 EFA process overview

Exploratory factor analysis		
Method	Measure	Rationale
Validation: Sample adequacy	Kaiser-Meyer-Olkin (KMO)	To determine whether the sample size is appropriate for an EFA
Significance of correlation matrix	Bartlett's test of Sphericity	To determine the significant of the intercorrelation between variables
Factor extraction method, rotation method, and factor loadings	Principal axis factor (PAF)	To find the number of factors in the data and salient factor loading
	Promax rotation (oblique rotation method)	
	Factor loading	

Adapted from (Hair et al., 2019)

4.5.1.1. The Kaiser-Meyer-Olkin (KMO)

The Kaiser-Meyer-Olkin (KMO) test of sample adequacy measures whether the data is suitable for factor analysis (Brown, 2015). The KMO tests the pattern and intercorrelation between observed variables and confirms the extent to which a correlation matrix contains factors (Hair et al., 2019). The results range between 0 and 1, KMO result below 0.5 is unacceptable, whereas a value above 0.8 is meritorious – 0.5 is the threshold (Hair et al., 2019).

4.5.1.2. The Bartlett's test of sphericity

The Bartlett's test of sphericity measures the overall significance of correlations between observed variables and thus factorability (Hair et al., 2019). The statistical significance of the correlation shows the extent to which the observed correlations resemble an identity matrix. An identify matrix is a correlation matrix denoted by diagonals with 1 and

off-diagonals with zero, variables in this matrix are unrelated. Results of a Bartlett's test of sphericity with a significant value below 0.05 ($p < 0.005$) show that the observed correlation matrix contains variables that are related and thus fit for an EFA.

4.5.1.3. Factor extraction, rotation and loading.

The factor extraction method used is the principal axis factoring with Kaiser normalisation. The principal axis factoring method is a common factor method that finds factors based on the correlations between observed variables, it seeks to find the least factors (Hair et al., 2019). Factor extraction for this research was predetermined by the research objectives and prior research as one of the many methods usable (Brown, 2015; Hair et al., 2019).

Each factor represents a simple structure defined by factor loadings that show the degree to which observed variables load on a factor (Hair et al., 2019). Loadings of 0.3 or 0.4 are salient loadings; they show a minimum significant association between a factor and an observed variable (Brown, 2015). Though loadings of 0.5 are acceptable, a loading of 0.7 indicative of a well-defined factor-observed variable association (Hair et al., 2019). Cross-loading occurs when an observed variable has salient loadings of 0.3 or 0.4 on more than one factor (Brown, 2015). This implies there is a primary and secondary factor (Brown, 2015). Though there is no framework for cross-loadings, researchers deleted observed variables with cross-loadings as it is advised to seek factor interpretability, simplicity of structure as the primary goal (Hair et al., 2019).

4.6. Structural equation modeling

The covariance-based structured equation model (CB-SEM) is a second-generation multivariate statistical tool capable of simultaneously and efficiently estimating multiple regression equations (Hair et al., 2019; Svensson, 2015). CB-SEM offers an efficient means of examining correlations between multiple latent constructs, both independent and dependent variables.

The six SEM steps as outline in literature are as follows (Hair et al., 2019)

(1) Define individual constructs done using the literature review
(2) Develop the overall measurement model: conceptual model illustrates the model identifying the independent and dependent variable.
(3) Design a study to produce empirical results: measurement instrument design,

survey, sample size and population for the study done as part of the study design

(4) Assess the measurement model validity: this was conducted using the CFA, scale validity (convergent validity and discriminant validity) and reliability (composite reliability of all the constructs) and the respective threshold as outlined in table 4 below.

(5) Specify the structural model: the measurement model was converted into a structural model using Amos

(6) Assess structural model validity: The model's fitness was be conducted as outline in table 4 to ensure using absolute fit indices and incremental fit indices.

Table 4 structural equation modeling thresholds used in the study

Structural equation modeling		
Measurement Model	**Method**	**Thresholds/range**
First-order and second-order confirmatory factor analysis		
Construct reliability	Composite Reliability (CR) Coefficient	Acceptable: 0.6 – 0.7, satisfactory to good: 0.7 – 0.9
Construct validity	Factor loadings	Acceptable: > 0.5, Ideal: > 0.7 (for large samples size >300, 0.3 acceptable)
	Convergent Validity: measured using the Average Variance Extracted (AVE)	>0.5
	Discriminant Validity: average variance extract (AVE) of construct is compared to squared correlation between constructs.	Square root of AVE > correlation
Structural model	**Method**	**Thresholds/range**
Model Fit Analysis: Absolute fit indices	CMIN/df: Chi-square (χ^2)/ degree of freedom	≤ 3
	Root Mean Square Error of Approximation (RMSEA)	<0.07
Model Fit Analysis: Incremental fit indices	Tucker Lewis Index (TLI)	>0.92 good
	Comparative Fit Index (CFI)	
Hypothesis testing & mediation analysis method		**Rationale**
Hypothesis Testing	Path estimate and variance explained	To confirm hypothesis and degree of significant
Mediation analysis	Bootstrapping	To confirm if ED is a mediator

Adapted from (Hair et al., 2019) for samples > 250 and observed variables > 30

4.6.1. Measurement model

The measurement model defines the relationship between the observed variables and

the constructs (Hair et al., 2019). Observed variables are assigned to construct, hence the importance of coding of constructs. The observed variables either form or reflect the existence of a construct (Christophersen & Konradt, 2012). Constructs are operationalised based on the underlying assumptions about the causal relationship with the observed variables. The direction of the causality, cause and effects, between the observed variable and construct differentiate the measurements into two types, reflective and formative measurements (Christophersen & Konradt, 2012; Hair et al., 2019). Reflective measurement model assumes that observed variables reflect the existence of the construct variable (i.e., the arrows point from the construct to the indicator); formative measurements give rise to the construct by creating a collection of observed variables that form the construct – the arrows points from the indicator towards the construct (Christophersen & Konradt, 2012; Hair et al., 2019).

4.6.1.1. Confirmatory factor analysis

Confirmatory factor analysis confirms if the data fits the proposed structure of the underlying variables (Hair et al., 2019). A confirmatory factor analysis constrains observed variables to load on a factor/construct and confirm reliability and validity of the loadings (Hair et al., 2019). The factor loading and validation of the correlation of the constructs is measured using the thresholds outlined in Table 4. The overall result of the CFA provided insight into the model fitness and the extent to which the constructs explained the variance in the measured constructs (Brown, 2015).

4.6.1.2. Construct reliability (Internal consistency)

Composite reliability (CR) measures the precision of the measurement instrument, measuring the degree to which observed variables in an instrument measure the same things. CR measure internal consistency of observed variables in a measurement scale and thus the construct (Hair et al., 2019). It is an alternative to the Cronbach alpha and deemed more reliable (Brown, 2015; Hair et al., 2019). A higher CR value reflects internal consistency between observed variables, meaning they reliably measure the same latent factor. A measure of 0.6 to 0.7 is acceptable, greater the score the higher the reliability (Hair et al., 2019)

4.6.1.3. Convergent validity

Convergent validity confirms whether observed variables (which represent questions on a scale) measuring the same or related theoretical construct (latent factor) have a high

correlation (Hair et al., 2019). Communality between observed variables is evidence of convergence. This study measured convergent validity using factor loadings and the average variance extracted (AVE), also known as the Fornell-Larker AVE criterion (Fornell & Larcker, 1981) for evaluating convergent validity.

Hair et al. (2019) recommends that each standardised indicator loadings (regression weights) should be at least 0.5 and preferably 0.7. Loadings affect the average variance of a factor, thus the higher the loadings, the better the AVE (Brown, 2015; Hair et al., 2019).

The AVE is calculated by multiplying standardised factor loadings themselves (squaring) to create squared standardised factor loadings. Squared standardised factor loadings of a latent factor are summed together and divided the number of observed variables in the factor; the result is an average standardised factor loading or an average variance extracted (AVE) for a latent factor. The threshold for an acceptable AVE is 0.5 or greater (Hair et al., 2019). An AVE of 0.5 means the factor explains 50% of the variance between the observed variables.

4.6.1.4. Discriminant validity

Discriminant validity measures the absence of correlations between constructs measuring theoretically distinct constructs. Constructs that are theoretically different should have a relatively low correlation between them. Discriminant validity is measured by comparing the squared AVE with the correlation between constructs or the AVE with the squared correlations (Brown, 2015; Hair et al., 2019). Discriminant validity is achieved when the squared AVE > correlations (shared variance) between the constructs (Hair et al., 2019).

4.6.1.5. Second-order confirmatory factor analysis

A second-order CFA was conducted to specify are a more interpretable solution that accounts for the correlations between the first-order constructs or explain a multidimensional construct at a higher level of abstraction, not at the level of its subscales (Hair et al., 2019). A higher-order factor account for correction between multiple factors or dimensions of a construct. Constructs defined by multiple subscales are layered into various levels, the first lower level contains first-order constructs and next layers represent the higher-order construct – a higher abstraction also termed a higher-order factor (Brown, 2015; Hair et al., 2019). First-order factor constructs function as observed

variables of the second-order construct, their presence in the model is only to function as observed variables (Brown, 2015; Hair et al., 2019) This study used the term second-order factor to describe a higher-order factor for dynamic capabilities (Makkonen et al., 2014) and complexity leadership (Diesel & Scheepers, 2019). They are both second-order constructs. Second-order constructs must have theoretical justification and grounding (Hair et al., 2019).

In absolute terms, the first-order model fits better than the second-order model as it as it captures more variance because it has more paths, but the higher-order model has fewer degrees of freedom (parsimony) and thus should have better measures of parsimony such as the RMSEA (Hair et al., 2019). All rules applying to a first-order model must apply to a second-order factor (Hair et al., 2019), construct validity and discriminant validity apply.

4.6.2. Structural model

The CB-SEM structural model converts the measurement model into a graphically displayed measurement of correlations between constructs (Hair et al., 2019). The measurement model was converted into a structural model by swapping the double-headed arrows with single-headed arrow that maps the cause-and-effect relationship between constructs (Hair et al., 2019). The relationship between constructs was measured with a path estimate that served as an equivalent to regression coefficient (Hair et al., 2019).

The chi-square (χ^2) measures the variance between the estimated and the observed covariance matrices (Hair et al., 2019). The chi-square's p-value compares the estimated covariance with the observed covariance to test the models' ability to approximate the observations, called degrees of freedom (Hair et al., 2019). The statistical significance of the χ2 measure in SEM supports model fitness when relatively high, p value > 0.05 because it indicates there is no statistical difference between the observed and estimated covariance metricises (Hair et al., 2019).

The model's goodness of fit was assessed using absolute fit indices and incremental fit indices as outline in Table 4. The model fitness confirmed whether the model fits the collected data in the covariance matrix (Hair et al., 2019). At minimum, fitness is measured using one absolute fit index and one incremental fit index (Hair et al., 2019).

Absolute fit indices used are the normed chi-square (CMIN/df) represented as the chi-square (χ^2)/degree of freedom (df), and the root mean square error of approximation (RMSEA). Chi-square (χ^2)/degree of freedom (CMIN/df) measure the minimum discrepancy per degree of freedom (df) (Hair et al., 2019). The close to zero, the better the fitness measure. The acceptable threshold is a CMIN/df < 3 (Hair et al., 2019). The root mean square error of approximation (RMSEA) measures the badness of fit, the distance between estimated covariance matrix and observed covariance matrix (Hair et al., 2019). A low RMSEA showed that the model fits whereas the high RMSEA showed poor fit. The threshold range is <0.07 (Hair et al., 2019).

Incremental fit indices are comparative indices that incrementally compare fitness of an estimated model with a null model where a perfect fit is represented by one, with an imperfect fit zero–see Table 4. Tucker Lewis index (TLI) and comparative fit index (CFI) form part of the incremental fit indices (Hair et al., 2019). Tucker Lewis index measures the CMIN/df variance between of the null and specified model, but the values can fall below 0 and exceed 1. The comparative fit Index measures fitness improvement and ranges between 0 and 1. CFI and TLI thresholds were > 0.92 as recommended by Hair et al. (2019) for models with samples > 250 and observed variables > 30.

4.6.3. Mediation analysis

Testing for the mediation effects was conducted using Amos 26 and used structural equation modeling. A mediation effects happens when another variable intervenes in the relationship between two or more constructs (Baron & Kenny, 1986; Hair et al., 2019). The extent of the mediation is defined by the reduction in the direction when the mediator is introduced (Baron & Kenny, 1986). This means the mediating variable acts as a facilitator of the relationship between the constructs and the properties of the mediation is in the results of its introduction, either its not affective at all, partially or fully (Hair et al., 2019).

For this to occur there must be a significant direct relationship between all the constructs in the model, the independent variable(s) → dependent variable(s), independent variable(s) → mediating variable(s), and mediating variable(s) → dependent variable(s) (Baron & Kenny, 1986; Hair et al., 2019). Full mediation is present when the direct relationship between the independent variable(s) and dependent variables (s) becomes insignificant when controlled for the effects of the mediating variable (Baron & Kenny, 1986; Hair et al., 2019). If there is still a significant direct relationship when controlled for the mediating effect then it is deemed to be a partial

mediation Baron & Kenny, 1986; Hair et al., 2019).

The bootstrapping technique was used for the mediation. Bootstrapping is a re-estimation technique that that samples the variables numerous times, a 2000 sample bootstrapping would involve 2000 re-estimations of each parameter coefficient (Hair et al., 2019).

4.7. Limitations

There are limitations in the research paper that constraint the extent to which the results can be generalised (Creswell & Creswell, 2018). The method used for samples was two-fold, convenience sampling followed by snowballing; this paper did not follow probability sampling.

5. Results

This chapter presents the key findings and interpretation of the results. The data was collected using a survey instrument and was analysed using the method outlined in chapter 4. The hypothesis outline in Chapter 3 was tested and preliminary findings briefly discussed.

The outline of the chapter is as follows. First is the data preparation process, which is followed by the characteristic of the respondents. This was followed by measurement of the reliability of the scales, exploratory factor analysis, confirmatory factor analysis, and conclude with the results from the hypothesis testing.

5.1. Data preparation and missing data

5.1.1. Data editing and missing data

The total number of responses collected was 1759. Not all respondents completed the survey. The results are depicted in Table 5. 1025 respondents completed the survey, whereas 734 started but did not finish. None-responses results in missing data as questions are left unanswered. Respondents deemed ineligible were 439 because they did not answer questions and thus can't be confirmed if they met the criteria for participation or whether they consented to taking part.

Table 5 Respondents statistics researchers own data

Description	Ineligible respondents			Survey dropouts				Completed	Total responses
Response count	1	437	1	235	40	4	16	1025	1759
survey completion rate	0%	2%	3%	33%	68%	78%	90%	100%	
Dropout spread				80%	14%	1%	5%	0%	
Total count	439			295				1025	1759
% per section	25%			17%				58%	100%

Though using varying strategies for dealing with missing data is recommended (Hair et al., 2019), the researcher opted for deleting the missing data. Missing data refers to missing information in a response. The survey ensured all questions were answered before a respondent moved to the next section. Missing data was because of the respondents dropping out of the survey; no missing data formed part of the completed surveys. The amount of missing data was large and not ignorable (Hair et al., 2019), it included values missing at a construct-level. Further analysis of the missing data was not conducted, all missing data was deleted as the remaining data exceeded the samples

numbers needed for a structural equation modelling.

5.1.2. Outliers

The Mahalanobis (D2) measure in Amos was used to detect multivariate outliers. Outliers are extreme cases that may adversely affect the study (Hair et al., 2019). The total number of outliers detected below the conservative 0.001 threshold was 72, these cases were all deleted from the data. The responses remaining were 953, and these formed the data for the study.

5.1.3. Reverse codes question

One reverse question forming measuring environmental dynamism was recoded before data analysis. Meaning the responses were swapped that they become positively worded. The recoding resulted in all responses that had strongly disagree recoded into strongly disagree. The recoding applied to all responses accordingly.

5.1.4. Normality testing

Multivariate normality assumptions were assessed using skewness and kurtosis. The results are depicted in Table 6 below. They show there were no values beyond the skewness and kurtosis threshold ranges recommend by Hair et al. (2019) of -2.58 and +2.58 for a significant level of 0.1 nor beyond the -1.96 and +1.96 0.05 significant level range. The standardised observed variables that use Z-scores did not yield contrary skewness and kurtosis measures (see Table 19); they showed the data was within the threshold and thus normally distributed. The normality results using the original scales are outlined in Table 6 below.

Table 6 Skewness and Kurtosis

Descriptive Statistics									
Observed variables	N	Minimum	Maximum	Mean	Std. Deviation	Skewness		Kurtosis	
	Statistic	Statistic	Statistic	Statistic	Statistic	Statistic	Std. Error	Statistic	Std. Error
PA1	953	1.00	5.00	3.576	1.053	-0.464	0.079	-0.321	0.158
PA2	953	1.00	5.00	3.489	1.082	-0.356	0.079	-0.603	0.158
PA3	953	1.00	5.00	3.433	1.169	-0.288	0.079	-0.802	0.158
PA4	953	1.00	5.00	3.365	1.122	-0.298	0.079	-0.692	0.158
PA5	953	1.00	5.00	3.222	1.237	-0.152	0.079	-0.939	0.158
PA6	953	1.00	5.00	3.156	1.361	-0.142	0.079	-1.221	0.158
DN1	953	1.00	5.00	3.311	1.209	-0.295	0.079	-0.826	0.158
DN2	953	1.00	5.00	2.884	1.250	0.131	0.079	-0.972	0.158
DN3	953	1.00	5.00	3.113	1.201	-0.106	0.079	-0.864	0.158
DN4	953	1.00	5.00	3.486	1.162	-0.436	0.079	-0.646	0.158
DN5	953	1.00	5.00	3.596	1.211	-0.476	0.079	-0.748	0.158
DN6	953	1.00	5.00	3.525	1.199	-0.416	0.079	-0.775	0.158
CI1	953	1.00	5.00	3.658	1.119	-0.559	0.079	-0.463	0.158
CI2	953	1.00	5.00	3.614	1.082	-0.520	0.079	-0.393	0.158
CI3	953	1.00	5.00	3.409	1.028	-0.371	0.079	-0.343	0.158
CI4	953	1.00	5.00	3.335	1.260	-0.306	0.079	-0.933	0.158
CI5	953	1.00	5.00	3.468	1.070	-0.422	0.079	-0.406	0.158
CI6	953	1.00	5.00	3.867	1.169	-0.848	0.079	-0.172	0.158
CI7	953	1.00	5.00	3.634	1.223	-0.573	0.079	-0.631	0.158
DCOBS1	953	1.00	7.00	5.158	1.554	-0.942	0.079	0.175	0.158
DCOBS2	953	1.00	7.00	5.093	1.643	-0.885	0.079	-0.153	0.158
DCOBS3	953	1.00	7.00	4.743	1.670	-0.662	0.079	-0.488	0.158
DCOBS4	953	1.00	7.00	4.939	1.597	-0.799	0.079	-0.181	0.158
DCREN1	953	1.00	7.00	4.778	1.821	-0.563	0.079	-0.793	0.158
DCREN2	953	1.00	7.00	4.682	1.789	-0.560	0.079	-0.697	0.158
DCREN3	953	1.00	7.00	4.711	1.747	-0.599	0.079	-0.613	0.158
DCREN4	953	1.00	7.00	4.554	1.737	-0.483	0.079	-0.749	0.158
DCACQ1	953	1.00	7.00	5.171	1.497	-0.893	0.079	0.247	0.158
DCACQ2	953	1.00	7.00	4.469	1.620	-0.370	0.079	-0.677	0.158
DCAQC3	953	1.00	7.00	4.868	1.728	-0.707	0.079	-0.442	0.158
DCAQC4	953	1.00	7.00	4.732	1.580	-0.604	0.079	-0.335	0.158
DCREC4	953	1.00	7.00	4.778	1.680	-0.638	0.079	-0.480	0.158
DCREC5	953	1.00	7.00	4.671	1.676	-0.588	0.079	-0.630	0.158
DCREC6	953	1.00	7.00	4.535	1.654	-0.466	0.079	-0.733	0.158
DCREN8	953	1.00	7.00	4.830	1.667	-0.646	0.079	-0.397	0.158
DCREN9	953	1.00	7.00	4.785	1.672	-0.671	0.079	-0.466	0.158
DCREN10	953	1.00	7.00	4.917	1.785	-0.746	0.079	-0.464	0.158
DCREC1	953	1.00	7.00	5.388	1.562	-1.140	0.079	0.724	0.158
DCREC2	953	1.00	7.00	5.120	1.657	-0.967	0.079	0.153	0.158
DCREC3	953	1.00	7.00	5.475	1.507	-1.151	0.079	0.815	0.158
ED1	953	1.00	7.00	5.619	1.422	-1.250	0.079	1.189	0.158
ED2	953	1.00	7.00	5.145	1.519	-0.850	0.079	0.130	0.158
ED3	953	1.00	7.00	5.737	1.333	-1.340	0.079	1.562	0.158
ED4	953	1.00	7.00	5.395	1.772	-0.999	0.079	-0.125	0.158
ED5	953	1.00	7.00	5.167	1.528	-0.853	0.079	0.093	0.158

5.1.5. Descriptive statistics

Descriptive statistics give noncausal information about the data (Creswell & Creswell, 2018; Hair et al., 2019). The descriptive statistics are separated into biographical information and company demographics. The total number of respondents for this study was 953.

5.1.6. Biographical data

The biographical characteristic of the respondents is summarised below. The research population is people working in South Africa. The respondents work in different levels within their organisations, as depicted in Figure 7 below. Executives and entry level staff contributed 121 and 105 responses, respectively. Most of the responses were experienced level staff (266) followed by middle management (261). Employees working in different levels may view complexity leadership and a firm's dynamic capabilities differently.

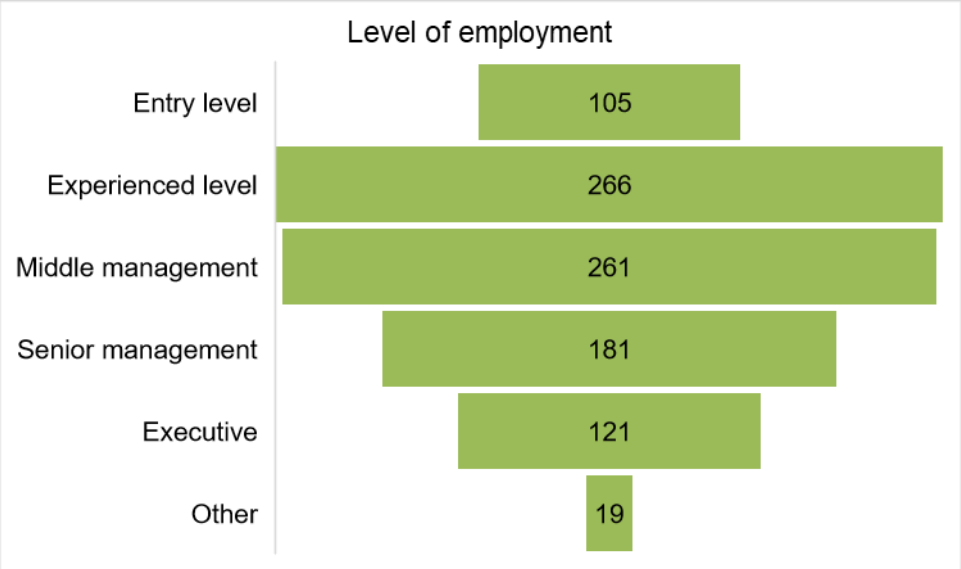

Figure 7 Level of employment

The racial profile of the data was not evenly dispersed. Most of the respondents were black (788), making up 83% of the total as depicted in Figure 8 below. This is not alarming considering the high number of black people in South Africa as compared to other racial groups (Stats SA, 2020).

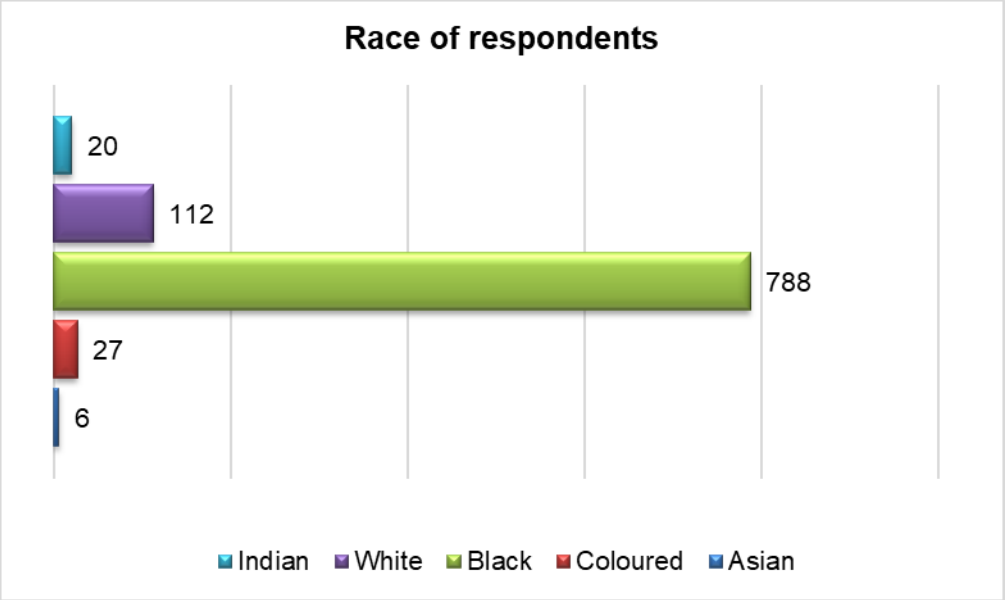

Figure 8 Race of the respondents

The gender distribution was 60.2% males, 39.6% females, and 0.2% classified themselves as other –see Figure 9.

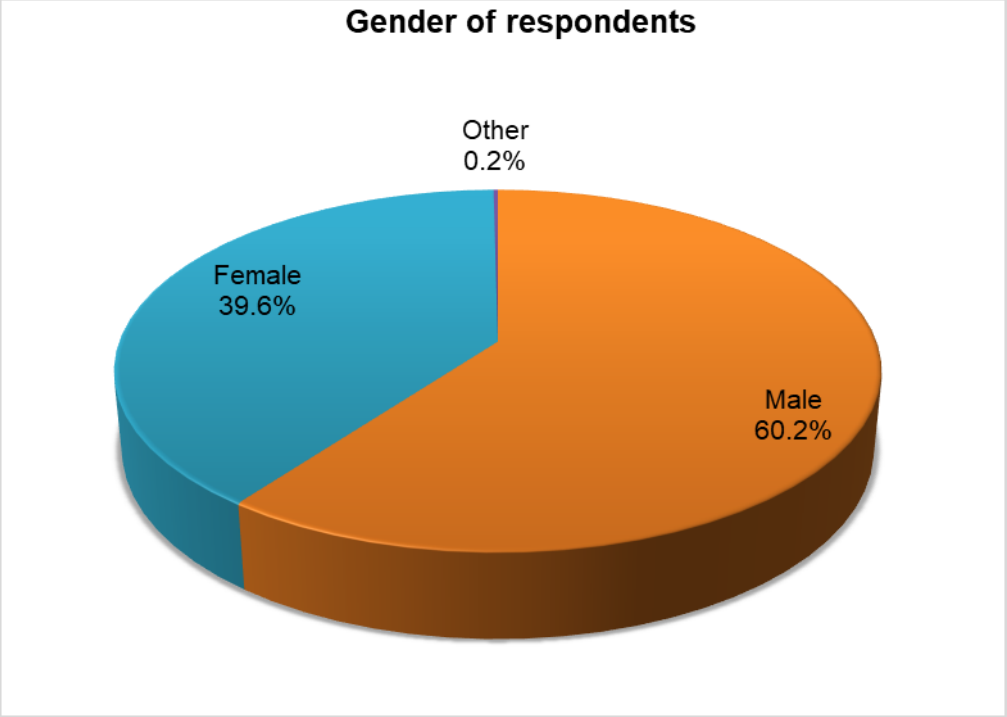

Figure 9 Gender of respondents

The respondents were further categorised into an age range. The distribution of the age is outlined in Figure 10 below. The dominant age range was the 31–40 year's group making up 43.5%, followed by the 20–30 age group that were 26.9% of the total. The age correlates with the level of employment in the firms with a concentration on the lower levels of employment (entry, experienced and middle management level) and the

younger employees (between 20–30 and 31–40 year's).

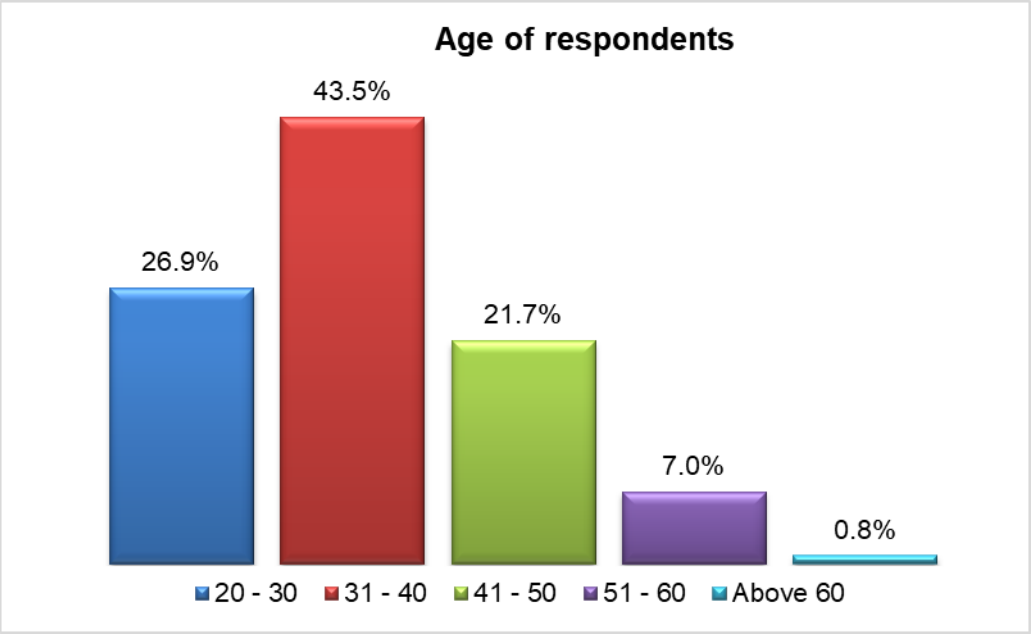

Figure 10 Age of respondents

5.1.7. Company demographics

According to the respondents, 46% believed their company was bureaucratic, whereas 54% thought it was entrepreneurial as outlined in Figure 11 below.

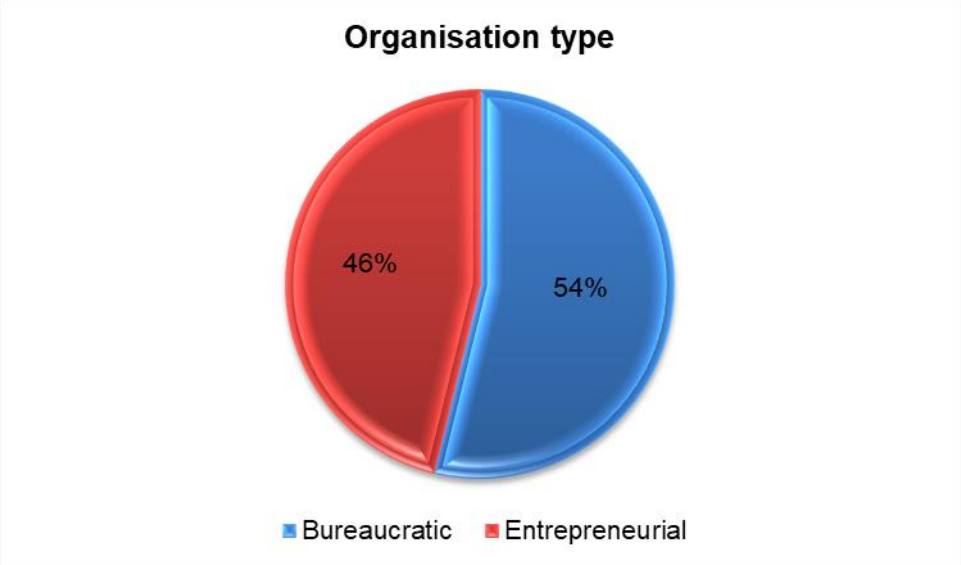

Figure 11 Organisation type

The revenue generated by these companies was predominately above R100 million, constituting 53% of the total company as outlined in Figure 12.

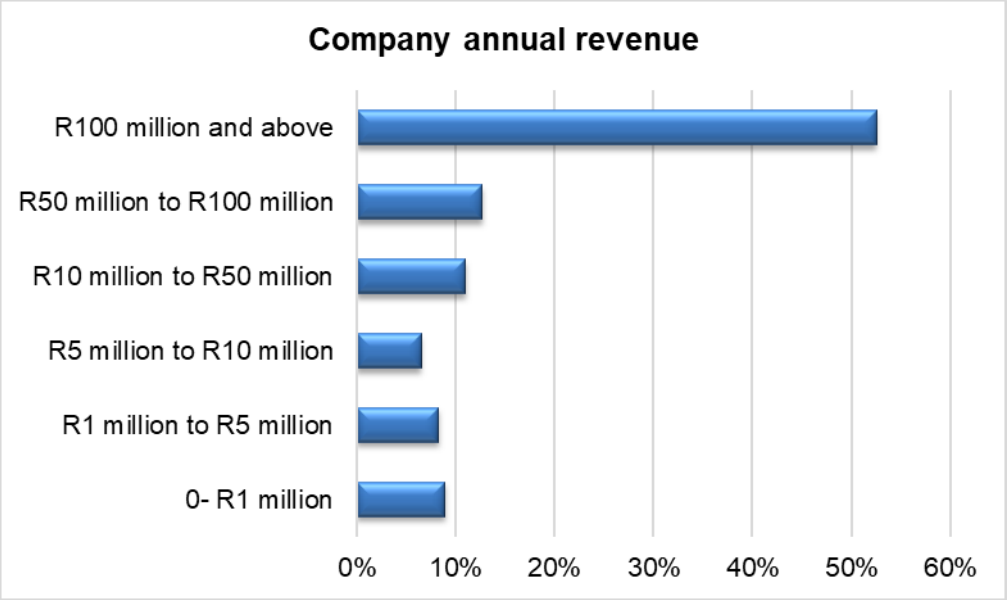

Figure 12 Company annual revenue

An overwhelming majority of the respondents work for large companies with different primary business activities. The two dominant areas of business were financial, services which is merged and includes financial services/banking and financial services/insurance, with 192 respondents (20%) and Government/SOC - state own entities with 127 respondents (13%) as shown in Table 20. Respondents unable to classify their entities opted to use other as category, and these made up 12% of the total. The rest of the statistics are included in Table 20 but didn't provide any significantly different statistics.

5.2. Exploratory Factor analysis

This section outlines the results from the exploratory factor analysis.

5.2.1. The Kaiser-Meyer-Olkin (KMO) and Bartlett's test of sphericity

Kaiser-Meyer-Olkin (KMO) test of sample adequacy measures the extent to which the data contains correlations between the observables and thus suitability for factor analysis (Hair et al., 2019). The samples collect was adequate as the KMO result outlined in Table 10 was 0.977 and exceeded the 0.5 threshold (Hair et al., 2019). The Bartlett's test of sphericity results reflected a significant level of p = 0.000. The samples are not identical

to an identity matrix that contains uncorrelated data; the data contains correlations that can be grouped into factors. Overall, the data is suitable for an exploratory factor analysis.

Table 7 Kaiser-Meyer-Olkin (KMO) and Bartlett's test of sphericity

KMO and Bartlett's Test		
Kaiser-Meyer-Olkin Measure of Sampling Adequacy.		0.977
Bartlett's Test of Sphericity	Approx. Chi-Square	32450.310
	df	990
	Sig.	0.000

5.2.2. Factor extraction

The principal axis factoring (PAF) with Kaiser normalisation was used to extract factors inline with prior research (Hair et al., 2019). The number of factors were specified to match complexity leadership, which is measured using three subscales (Diesel & Scheepers, 2019), dynamic capabilities as a construct with six subscales (Makkonen et al., 2014) and environmental dynamism measured as a single scale (Jansen et al., 2006). The Promax oblique rotation method was used to rotate the factors extracted. Factors below 0.3 were excluded, only salient loadings were kept (Brown, 2015).

5.2.2.1. Complexity Leadership

To align with the conceptualisation of complexity leadership defined by three-subscales, factor extraction was fixed to extra three factors. The results yielded three factors and interesting results as outlined in Table 8 below. Three observed variables (DN4, DN5 and DN6) measuring developing networks loading on contextual intelligence and one (DN1) measuring the same construct loaded on patterning attention. DN4 measured building networks internally, DN5 "embracing diversity by having diverse people and views" and DN6 focused on "gathering feedback information from external stakeholders".

Table 8 Complexity leadership Factor extraction

Pattern Matrix[a]			
Complexity Leadership			
Observed variables	Contextual intelligence	Patterning attention	Developing network
PA1		0.758	
PA2		0.627	
PA3		0.730	
PA4		0.727	
PA5		0.590	
PA6		0.640	
DN1		0.450	
DN2			0.794
DN3			0.897
DN4	0.431		
DN5	0.616		
DN6	0.654		
CI1	0.809		
CI2	0.876		
CI3	0.569		
CI4	0.453		
CI5	0.637		
CI6	0.678		
CI7	0.571		
Extraction Method: Principal Axis Factoring. Rotation Method: Promax with Kaiser Normalization.			
a. Rotation converged in 6 iterations.			

Aspects of contextual intelligence measure diversity, CI4 “Adapts his/her communication to different ethnic cultures in the organisation” and CI7 “Provide opportunities for diverse employees to interact in a non-discriminatory manner”. CI1 “Gathers intelligence from what is happening in the context like which threats and opportunities are developing” measures gathering of information. The correlation of DN5 and contextual intelligence may be because it has similar wordings with CI4 and CI7 which measure diversity, suggesting the method effect may be a key driver of the correlation and not the true variance between the items-hence the cross (Brown, 2015). Respondents may answer similarly worded questions in the same manner, heightening the correlations between them; this method effect is known as acquiescence response set (yea-saying and nay-saying) (Podsakoff et al., 2003). Acquiescence may be responsible for the high correlation and not true variance between the items. The same method effect applies to DN6 and CI1 as both measure gathering feedback (DN6) and gathering intelligence (CI1) and follow each other in the survey.

The pairs PA6:DN1 and DN6:CI1 following each other in the survey (proximity). DN1 measured “creating linkages between entities” and was the first developing network question after patterning attention. The covariance between the pairs suggests method effect has contributed to the high correlations between the pairs and influenced by the proximity between the observed variables (Podsakoff et al., 2003)

The goal of the EFA was to create a simple structure from the data. As a result, the cross-loading observed variable were deleted as recommended by Brown (2015). The factors extracted form the basis of further analysis.

5.2.2.2. Dynamic capabilities

Dynamic capabilities concept was operationalised using six-subscales and thus six factors (2019). To align with the predetermined factors, the factor extraction was fixed to six factors as the results shown in Table 9 below. Factor loadings below the 0.3 threshold were removed; the only observed variable removed for not meeting the loading threshold was DCAQ1. The observed variables DCREN10 was removed for having salient cross-loading on two other factors (Reconfiguration and Learning) except the factor it was expected to load on (Leveraging).

Table 9 Dynamic capabilities factor extraction

Pattern Matrix[a]						
Dynamic capabilities						
Observed variables	Knowledge creation (RENRD)	Learning (RECEMP)	Knowledge Integration (ACQNW)	Sensing and seizing (OBS)	Reconfiguration (RECRUT)	Leveraging (RENEMP)
DCOBS1				0.586		
DCOBS2				0.847		
DCOBS3				0.800		
DCOBS4				0.650		
DCREN1	0.828					
DCREN2	0.998					
DCREN3	0.886					
DCREN4	0.896					
DCACQ1						
DCACQ2			0.716			
DCAQC3			0.856			
DCAQC4			0.815			
DCREC4					0.861	
DCREC5					0.973	
DCREC6					0.448	
DCREN8						0.632
DCREN9						0.666
DCREN10		0.419			0.306	
DCREC1		0.877				
DCREC2		0.844				
DCREC3		0.770				
Extraction Method: Principal Axis Factoring. Rotation Method: Promax with Kaiser Normalization.						
a. Rotation converged in 6 iterations.						

5.2.2.3. Environmental dynamism

Environmental dynamism was operationalised using one scale. One factor was prespecified, and the results outlined in Table 10 below. Interestingly, ED4 had poor loadings onto environmental. ED4 was a reverse worded question asking “In a year, nothing has changed in our market”. Reversed-codes items are used to reduce method effects (Hair et al., 2019). Included negatively worded questions in a survey may improve respondents’ focus and reduces automated responses; reverse worded questions act “like cognitive “speed bumps” that require respondents to engage in more controlled, as opposed to automatic, cognitive processing” (Hair et al., 2019). Having established a pattern of responding, respondents may struggle to see that the questions is negatively worded or cannot understand its meaning.

Table 10 Environmental dynamism factor extraction

Factor Matrix[a]	
Environmental dynamism	
Observed variables	Environmental dynamism
ED1	0.582
ED2	0.601
ED3	0.852
ED4	0.330
ED5	0.630
Extraction Method: Principal Axis	
a. 1 factors extracted. 11	

The observed variable ED4 had a factor loading below 0.5. Though it is a salient loading as it is above 0.3 (Brown, 2015) and acceptable as an indicator, Hair et al. (2019) recommends keeping factor above 0.5 with 0.7 as the ideal target. Low factor loadings adversely lower the average variance extract (AVE) measure and may contribute to convergent validity issues (Hair et al., 2019)

The factor extraction supported the factors prespecified by theory. Complexity leadership had three factors, dynamic capabilities six and environmental dynamism one. These factors were used in structural equation modeling in the next section.

5.3. Structural equation modeling

This section covers the assessment of the measurement and structural model. First, measurement model is assessed using confirmatory factor analysis, and the followed by construct validity and reliability assessments. This was followed by testing the hypothesis using the structural model. This two-step approach ensures that theory is tested on a fitting model (Hair et al., 2019)

5.3.1. Measurement model

Confirmatory factor analysis was conducted first and the construct reliability and validity second. Confirmatory factor analysis and the measurement model are used interchangeability.

5.3.2. Confirmatory factor analysis

Confirmatory factor analysis was conducted, and the results outlined below. First is the model set up results.

5.3.2.1. Model setup

The measurement model comprises three constructs. The first construct is complexity leadership (CL) which is a second-order construct with three first-order constructs, patterning attention (PA), developing networks (DN) and Contextual intelligence (CI). The second construct is dynamic capabilities (DC) with two dimensions, renewing capabilities (RENEW) composed of sensing and seizing (OBS), knowledge creation (RENRD) and knowledge integration (ACQNW), and regenerative capabilities (REGEN) comprising reconfiguration routines (RECRUT), leveraging (RENEMP) and learning (RECEMP). The third and final construct is environmental dynamism (ED).

Dynamic capabilities is a multidimensional construct with two dimensions, renewing capabilities and regenerative capabilities. Renewing and regenerative capabilities are different aspects of dynamic capabilities, they are a different manifestation of the same construct (Brown, 2015). Though the two dimensions form different aspects, this study will focus on the main construct, dynamic capabilities. The measurement models are specified and measured the first-order constructs first and then the second-order constructs. CFA was conducted on Amos 26. The purpose of the measurement model is to confirm if the model fits the data. All constructs were drawn with their respective observed variables and error terms per variable. The relationship between the construct was drawn using a double-headed arrow.

The EFA process extracted leveraging (RENEMP) and developing network (DN) with two observed variables (indicators). Three to four observed variables per construct is recommended; a model with two observed variables is considered an unidentified construct (Brown, 2015). “Identification deals with whether enough information exists to identify a solution to a set of structural equations” (Hair et al., 2019). To convert an unidentified construct into a just-identified construct, equality constraints are placed on both observed variables. In other both words, both observed variables are constrained to one instead of a single constraint per construct (Brown, 2015). Equality constraints (Brown, 2015; Hair et al., 2019) were placed on both RENEMP and DN.

5.3.2.2. Initial measurement model fitness

The initial measurement model is outlined in Figure 13 below. The goodness-of-fit statistics (RMSEA, CFI, TLI etc) confirm that the model fits the data at a global level (2019). The global goodness-of-fit statistics results of the model (chi-square $\chi 2$ = 1334.759, degrees of freedom (df) = 622, P=0.000) were (RMSEA = 0.035, Chi-square/df: 2.146; CFI:0.973; TLI: 0.970). The good-of-fit statistics showed the model was significant (P <0.05) and the model fit the data as it was within the threshold recommended by (2015) RMSEA <0.07, Chi-square/df ≤ 3; CFI>0.92; TLI> 0.92.

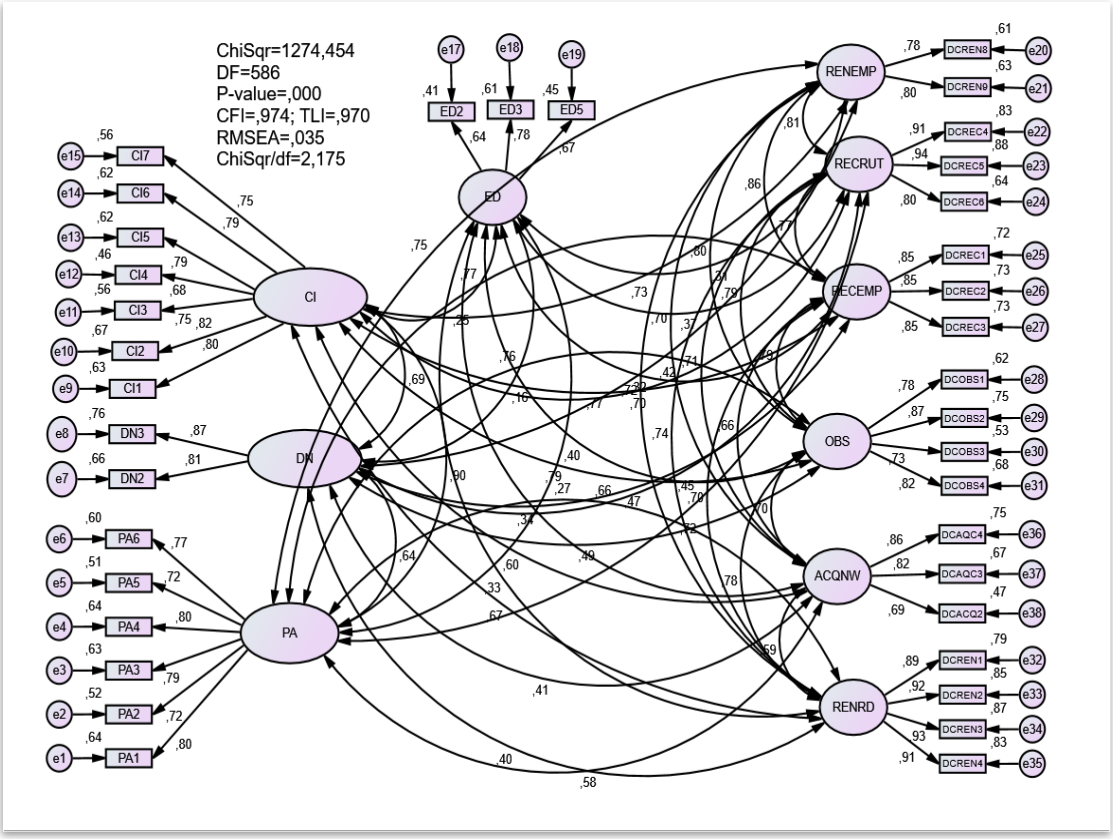

Figure 13 initial measurement model

Model diagnostics are reviewed even though the model fit at a global level (Brown, 2015). Local areas of misfit are reviewed, and modifications implemented if deemed fit (Hair et al., 2019). The areas reviewed are factor loadings, standardised residual and modification indices. However, Hair et al. (2019) warns against making model modification that are not substantiated by theory. Brown (2015) suggests that modification should be justified by prior research, theory or practical consideration and not merely from statistical suggestion or to improve the model fitness.

Standardised factor loadings (regression weights) were all above the 0.5

threshold, but ED1 measuring environmental dynamism was below the 0.6 threshold creating a potential problem for the average variance extracted measure, considering other loadings were below the desired 0.7 threshold (ED2 and ED5 were 0.64). As a result, ED1 was considered a candidate for deletion from the model as it threatened to reduce the AVE below the recommended 0.5 threshold. After deletion of ED1 the model-fitness statistics of the model (chi-square $\chi 2$: 1274.454, df: 586, P=0.000) were (RMSEA: 0.035, Chi-square/df: 2.175; CFI:0.974; TLI: 0.970).

Standardised residuals were all below 0.4 threshold recommended by Hair et al. (2019) as non-problematic residuals. No modifications indices were considered as the model fit was within the threshold, there were no large modifications justifiable by theory.

5.3.2.3. Construct reliability and validity assessment

The results of the construct reliability and validity tests are depicted in Table 11 below.

Table 11 Construct reliability, and convergent and discriminant validity

	CR	AVE	MSV	RENRD	OBS	ACQNW	RECRUT	RENEMP	RECEMP	ED	PA	DN	CI
RENRD	0.95	0.83	0.61	**0.91**									
OBS	0.88	0.64	0.65	0.78	**0.80**								
ACQNW	0.84	0.63	0.50	0.60	0.70	**0.79**							
RECRUT	0.91	0.78	0.66	0.74	0.79	0.71	**0.88**						
RENEMP	0.77	0.62	0.73	0.72	0.81	0.70	0.81	**0.79**					
RECEMP	0.89	0.73	0.73	0.71	0.79	0.67	0.77	0.86	**0.85**				
ED	0.74	0.49	0.16	0.33	0.40	0.34	0.37	0.31	0.32	**0.70**			
PA	0.90	0.59	0.81	0.66	0.76	0.58	0.72	0.75	0.77	0.27	**0.77**		
DN	0.83	0.71	0.47	0.40	0.50	0.41	0.45	0.42	0.47	0.16	0.65	**0.84**	
CI	0.91	0.59	0.81	0.67	0.80	0.60	0.70	0.73	0.77	0.25	0.90	0.69	**0.77**

The composite reliability (CR) measure was assessed to establish construct reliability and thus internal consistency of measures. A construct is reliability when it is above 0.7 (Makkonen et al., 2014). All constructs were above the 0.7 threshold and thus reliability was established Convergent validity is confirmed when the factor loadings and average variance extracted (AVE) are at least 0.5 (Hair et al., 2019). All standardised observed variables loading were above the 0.5 threshold. Environmental dynamism (ED) was the only construct on the verge of 0.5 (rounded off, 0.489 is 0.5). For this study, the AVE of 0.489 sufficed in establishing convergent validity. Discriminant validity measures the distinctness of theoretically distinct constructs (Brown, 2015). Complexity leadership constructs PA and CI are first-order constructs measuring the complexity which is their second-order construct (Diesel & Scheepers, 2019). For this study, they are not unique constructs, but constructs measuring complexity leadership. RENEMP and RECEMP

both measure regenerative capabilities (Makkonen et al., 2014). The correlations are theoretically justified and do not exceed 0.1 thus not alarming.

5.3.2.4. Second-order CFA

Second-order factor model must have the theoretical justification. Theory must underpin the existence of a second-order factor derived from first-order constructs (Hair et al., 2019). Complexity leadership is a reflective second-order construct measured by first-order constructs (PA, DN and CI) (Hair et al., 2019; Diesel & Scheepers, 2019). A second-order CFA is conducted on a well-fitting first-order model and should not significantly diminish the first-order model fitness. The results are depicted in Figure 14 below

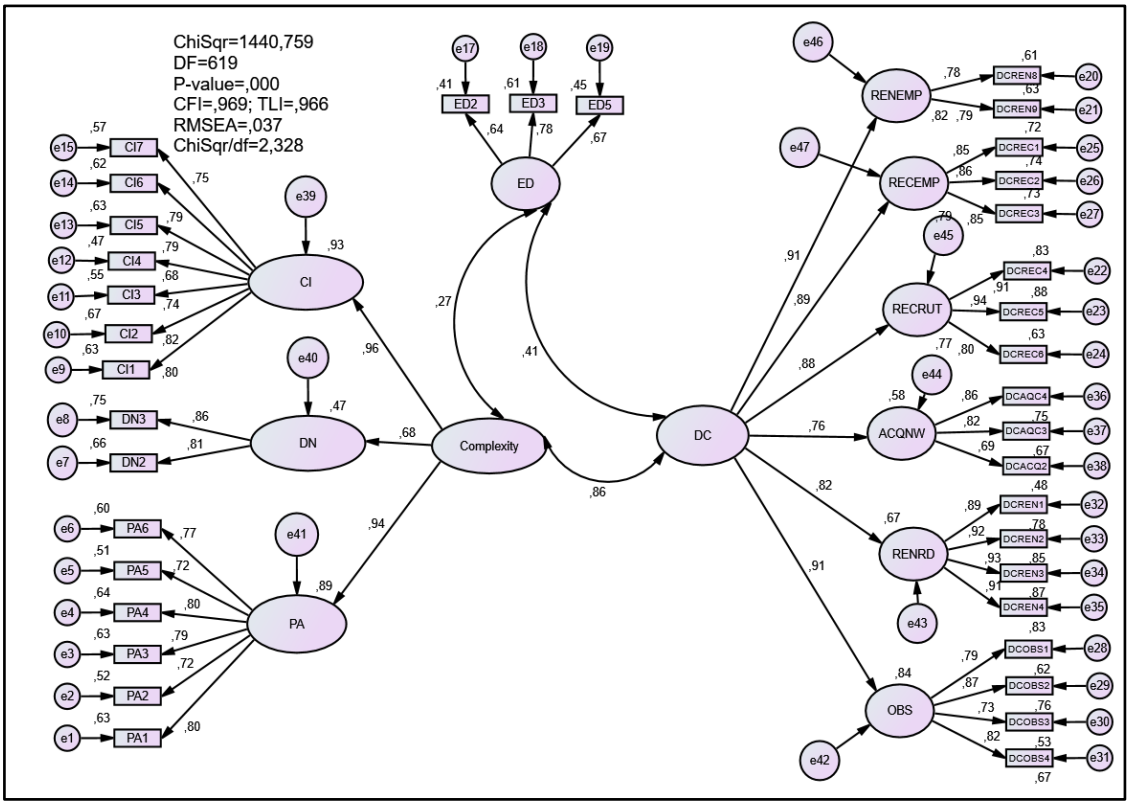

Figure 14 Second-order CFA

The second-order model fit statistic for the model (chi-square χ2: 1440.759 df: 619, P=0.000) were (RMSEA: 0.037, Chi-square/df: 2.328; CFI:0.969; TLI: 0.966). The model fit the data and within the thresholds recommended by Hair et al. (2019). In additional the model fit was not significantly diminished as a second-order model as compared to the first-order model as depicted in Table 12 below.

Table 12 first-order and second-order model comparison

Models	Models	Chi-square χ2:	df	RSMRA	Chi-square/df	CFI	TLI
1st order	First-order model	1274.454	586	0.035	2.175	0.974	0.97
2nd order	Second-order model	1440.759	619	0.037	2.328	0.969	0.966
Delta		166.31	33.00	0.00	0.15	- 0.01	- 0.00

5.3.2.5. Second-order construct reliability and validity assessment

A second-order factor model is subjected to the same rules as the first-order model (Brown, 2015). Construct reliability, and convergent and discriminant validity assessments apply to second-order constructs and other constructs in the model; the rules are not applied to the second-order construct and its first-order observed variables. The results of reliability and validity results are depicted in Table 13 below.

Table 13 second-order validity and reliability

	CR	AVE	MSV	ED	Complexity	DC
ED	0,741	0,489	0,165	**0,700**		
Complexity	0,903	0,760	0,741	0,270	**0,872**	
DC	0,945	0,743	0,741	0,406	0,861	**0,862**

Construct validity was established for all constructs, as CR was above the 0.7 threshold recommended by Hair et al. (2019). Except for ED with an AVE of the verge of 0.5, convergent validity was established for the other construct because the AVE is above 0.5 threshold (Hair et al., 2019). The AVE of ED is on the verge of 0.5 (0.49 rounded off is 0.5) and thus acceptable for this study. Discriminant validity was achieved between complexity leadership and dynamic capabilities as the squared AVE was higher than the correlations between the constructs (Hair et al., 2019).

5.3.3. Structural model

The measurement model is converted into the structural model by replacing the double-headed arrow with the single-headed arrows that denotes the causal relationship between constructs. In addition, error terms are added to endogenous variables in the model. The model is read from left to right, the exogenous variables on the left side and the endogenous variables on the right side. Complexity leadership (complexity) is an exogenous variable, whereas both environmental dynamism (ED) and the dynamic capabilities are endogenous variables.

5.3.3.1. Model fitness

The structural model is built to test the relationships hypothesised in chapter three. The model fitness statistic are depicted in Figure 15 below was conducted in Amos 26.

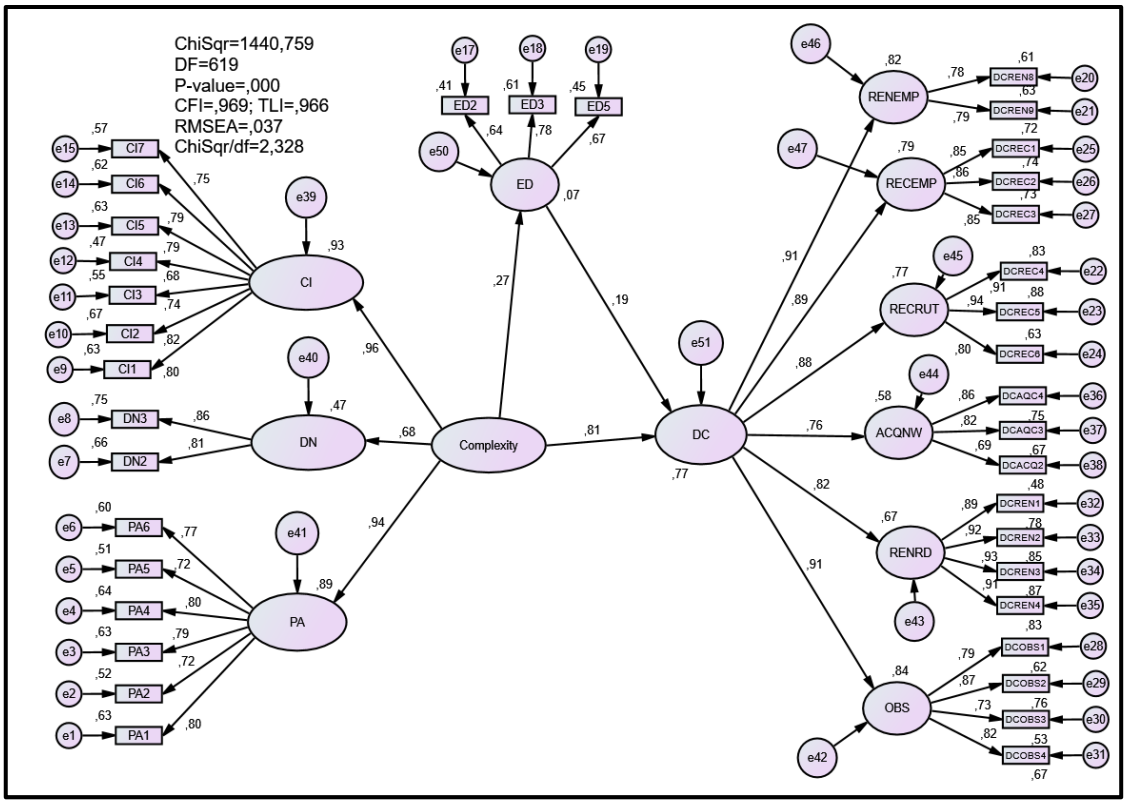

Figure 15 Measurement model fitness

The goodness of fit statistics for the model (chi-square χ^2 = 1440.759, df = 619, P= 0.000) were (RMSEA = 0.037, Chi-square/df = 2.328; CFI = 0.969; TLI = 0.966) and showed that the model fit the data and was within the fitness thresholds for models with unobserved variables > 30 and samples size > 250 as suggested by Hair et al. (2019). As the result, the model can be used for testing the hypothesis.

5.3.4. Hypothesis testing

This section covers the hypothesis testing using the path estimates, standardised regression weights (regression coefficient estimates) and the level of significance (P-level). The first section will cover the correlations between constructs.

Objective 1: There is a positive relationship between complexity leadership and

dynamic capabilities.

The results depicted in Table 14 below shows that was a positive and significant relationship between complexity leadership and dynamic capabilities. An increase in one standard deviation of complexity leadership leads to a 0.810 increase in the standard deviation of dynamic capabilities, at a 99% confidence interval. The null hypothesis is rejected, and the alternative hypothesis accepted.

Table 14 Standardised regression weights of complexity leadership and dynamic capabilities

Dependent variable		Independent variable	Estimate	P value
Dynamic capabilities	←	Complexity leadership	0.810	***

The results above led to the conclusion that complexity leadership is a strong predictor of dynamic capabilities. It explained up to 66% (0.810 *0.810) of the total variance in dynamic capabilities.

Objective 2: There is a positive relationship between complexity leadership and environmental dynamism.

The results show that complexity leadership had a positive and significant (P value was below 0.001 and symbolised by ***) relationship with environmental dynamism as depicted in Table 15 below. An increase in one standard deviation of complexity leadership leads to a 0.270 increase in the standard deviation of environmental dynamism, at a 99% confidence interval. As a result, the null hypothesis is rejected, and the alternative hypothesis accepted.

Table 15 Standardised regression weights of complexity leadership and environmental dynamism

Dependent variable		Independent variable	Estimate	P value
Environmental dynamism	←	Complexity leadership	0.270	***

In addition, this leads to the conclusion that complexity leadership is a predictor of environmental dynamism. It explains up to 7% (0.270*0.270) of the variance in environmental dynamism.

Objective 3: There is a positive relationship between environmental dynamism and dynamic capabilities.

The results in Table 16 showed that environmental dynamism had a positive and significant relationship with the dynamic capabilities. An increase in one standard deviation of environmental dynamism leads to a 0.187 increase in the standard deviation of dynamic capabilities, at a 99% confidence interval. The null hypothesis is rejected, and the alternative hypothesis accepted.

Table 16 Standardised regression weights of environmental dynamism and dynamic capabilities

Dependent variable		Independent variable	Estimate	P value
Dynamic capabilities	←	Environmental dynamism	0.187	***

Environmental dynamism is a predictor of dynamic capabilities. It explained up to 3% of variance in dynamic capabilities.

5.3.5. Mediation analysis

The mediation effect is confirmed by testing the direct and indirect effects of the mediating role of environmental dynamism on the relationship between complexity leadership and dynamic capabilities. This section will follow the mediation results and they hypothesis about the mediation effect of environmental dynamism.

5.3.5.1. Hypothesis testing

Objective 4: environmental dynamism mediates the relationship between complexity leadership and the dynamic capabilities.

Hypothesis 4 covered the mediating effect of environmental dynamism on the relationship between complexity leadership and dynamic capabilities. The results are outlined in Table 17 below. Bootstrapping was conducted with 2000 samples and a bias-correct confidence internal of 95%. This was to facilitate the estimation of the indirect effects of the mediating function of environmental dynamism.

Table 17 Mediation analysis

The mediating effects of environmental dynamism on the relationship between complexity leadership and dynamic capabilities.							
Dependent variables (DV)	The standardised mediated effects of complexity leadership on dependent variables						Findings
	Direct effect		Indirect effects		Total effects		
	Coef.	P	Coef.	P	Coef.	P	
Dynamic capabilities	0.810	0.001	0.050	0.000	0.861	0.001	Partial mediation

The results led to a conclusion that environmental dynamism partially mediates the relationship between complexity leadership and dynamic capabilities, as outlined in Table 17. The direct effects are significant, the coefficient is 0.810 and significant level 0.001. The indirect effects are significant, the coefficient is 0.861 and significant level 0.001. This means there is still a significant direct effect even after considering the mediating effect of environmental dynamism (Hair et al., 2019) showing the relationship between complexity leadership and dynamic capabilities is transmitted directly and through environmental dynamism as a mediator, hence the partial mediation results.

5.4. Chapter summary

In summary, this chapter focused on presenting the results from the data collection and analysis aimed at answering the research questions that arose from the literature review.

After data editing and review for missing data and outliers, 953 samples remained and used in the study. The demographics of the data showed the race of the respondents was predominately black (83%) followed by whites (11.8%). There were more male respondents (60.2%) than females (39.6%). The respondents were predominately working as experienced staff (266) and middle management (261) with only 121 executives.

The structural equation model assessment was preceded by an exploratory factor analysis that extracted factors based on the theory underlying the constructs to facilitate testing the theory. Using the factors extracted from the EFA, the covariance-based SEM was conducted to validate model fitness, firstly confirming if the model fit was acceptable, then conducting a first-order and second-order factor analysis before assessing the structural model based on the hypothesis. The model was found to fit but

adjusted for discriminant validity concerns before selecting the model to use for conducting a second-order CFA. The SEM results supported the hypothesis H1, H2 and H3. The mediation results showed that hypotheses H4 was supported only as partial mediation.

6. Chapter 6: Discussion of results

6.1. Introduction

The preceding chapter presented the empirically data collected, descriptive statistics of the data, exploratory factor analysis, structural equation modeling (SEM) which covers measurement and structural models, hypothesis testing and mediation analysis. SEM conducted included testing of the instrument's reliability and validity, model fitness checks, first-order and second-order confirmatory factor analysis. This chapter discusses the results presented in chapter 5 while incorporating the findings with literature. The data collection and editing process results are discussed next.

6.2. Data collection and editing

The data collected from 1759 respondents resulted in 953 samples remaining after responses with missing data and outliers. The survey dropout rate was 17% (295) and ineligible respondents were 25% (439) of the total – see Table 5. The reasons respondents don't take part in surveys or drop out vary. It includes ineligibility, general refusal to give consent, and survey fatigue. The reason for dropping out of the survey was not collected. Shorter surveys have a lower dropout rate than longer survey (Bell et al., 2019). Information on the reason for dropping out of the survey was not collected. Respondents who completed all questions were 58% of the total.

Normality

Normality assessments in Table showed the data had a normal distribution. The data fall within the kurtosis and skewness threshold of ± 2.58 as recommended by Hair et al. (2019). Many of the responses were above the mean, as the data had a negative skewness rate (Hair et al., 2019). The kurtosis results showed the data was platykurtic, it contained a low peakedness and lighter tail distribution (Hair et al., 2019). This means the data had fewer extremely positive or negative responses.

6.3. Biographical and company demographics

Though descriptive statistics cannot show the nature of the relationship between constructs, they provide insight about the respondents and variety in the data such as

frequency, dispersion and mean (Creswell & Creswell, 2018).

Level of employment

The respondents' level of employment varied, it included entry level staff (105), middle management (261) and executives (121). The sample was not overly concentrated with senior management and executives. Though leadership studies are geared towards senior members of organisations, complexity leadership and dynamic capabilities recognise the role of both upper and lower echelons employees (Hambrick & Mason, 1984) play as resources available to the firm (Schilke et al., 2018; Uhl-Bien & Arena, 2018). Scheepers & Shuping (see Diesel & Scheepers, 2019) suggests that employees in managerial levels were prone to being more positive about the organisation. The breadth in the level of the respondents' employment provides the study with broader perspectives and insight.

Biographical information

The respondents included more males (60.2%) than females (39.6%), more blacks (788) than other race groups (165 of the total 953). According to Stats SA (2020), South Africa is estimated to have more females (30.5 million) than males (21.9 million), and more black people (48.1 million of the 59.6 million total South African population estimate) than the other racial groups. The racial dispersion was not alarming given the country's demographics. Academically, the respondents were primarily postgraduates (56.3%) and had over 2 years working in their current organisation. Only 312 of the 953 had 0-2 years' experience with their current employer. The researcher was satisfied with these statistics, as it means the respondents have had a significant amount of time with the employer for well-informed feedback about the measurements and constructs of interest.

Organisational demographics

Some respondents viewed their organisational as bureaucratic (53.8%) and other entrepreneurial (46.2%). The organisations they worked for were primarily large entities, with over 1000 employees (43.4%), 50+ years conducting business (41.2%) and generating revenue over R100 million (52.6%). Bureaucratic organisations are associated with structures that stifle information flow, slow down adaptability geared towards exploitation approaches, and are associated with top-down and formal leadership, (McBride, 2016; Uhl-Bien & Arena, 2018). Entrepreneurial leaders and organisations are associated with exploration, seeking novel routines, reconfiguration of resources, bottom up (informal) style of leadership that encourages seeking new

perspectives, patterning attention, collaboration and transfer of information in the organisation (Osborn et al., 2002; Osborn & Marion, 2009; Osborne & Hinson, 2011; Uhl-Bien & Arena, 2018). This means the respondents are balanced between people who should have experienced and those who have not experienced complexity leaders and dynamic capabilities attributes, the response exhibit a balanced and diverse group.

6.4. Exploratory factor analysis

The exploratory factor analysis was conducted using theory as the foundations, an alternative approach recommended by Hair et al. (2019). Complexity leadership was mapped to three factors matching the three scales (see Table 8), dynamic capabilities matching six scales (see Table 9) and environmental dynamism one scale (see Table 10). Complexity leadership and dynamic capabilities are theorised as second-order factor that use the subscales (constructs) as reflective indicators; the subscales function as constructs that create the second-order construct in the same way observed variables reflect a construct (Diesel & Scheepers, 2019; Hair et al., 2019; Makkonen et al., 2014).

6.5. Structural Equation modeling

The structural equation model covered two major sections, measurement model and structural model. The initial measurement model results indicated the model fit the data after deletion of the one observed variable loading on environmental dynamism. The fitness statistics of the model (chi-square $\chi 2$: 1274.454, df: 586, P=0.000) were (RMSEA: 0.035, Chi-square/df: 2.175; CFI:0.974; TLI: 0.970) meeting the recommended threshold (Hair et al., 2019). The construct reliability and validity model were in line with the recommended threshold, considering the complexity leadership subconstructs were explained by the higher-order construct and thus represent the umbrella constructs and thus not unique. Dynamic capabilities was conceptualised as superordinate multidimensional construct with two dimensions, renewing capabilities and regenerative capabilities; but this paper focused on the main construct and not the dimensions (Makkonen et al., 2014).

A second-order confirmatory factor analysis was conducted after confirming that the first-order confirmatory factor fit the data. The model fit statistic for the model (chi-square $\chi 2$: 1440.759 df: 619, P=0.000) were (RMSEA: 0.037, Chi-square/df: 2.328; CFI:0.969; TLI: 0.966). It showed that the second-order confirmatory factor analysis model fit the data and within the thresholds recommended by Hair et al. (2019).

The measurement model was converted into the structural mode to measure causal relationships between the constructs. The goodness of fit statistics for the model (chi-square $\chi 2$ = 1440.759, df = 619, P= 0.000) were (RMSEA = 0.037, Chi-square/df = 2.328; CFI = 0.969; TLI = 0.966) and within the recommended threshold (Hair et al., 2019).

With the measurement and structural model showing the data fit the model, testing of hypothesis was conducted. The results of the testing are discussed below.

6.6. Hypothesis testing

Schilke et al. (2018) highlighted the need for further research into leadership as an antecedent to dynamic capabilities, suggesting it was a fertile ground for research. Uhl-Bien & Arena (2018) highlighted the scarcity of leadership research focusing on adaptability and suggested future research should focus on adaptability and the enabling the adaptive process. This paper is built on these two foundations seeking to find the mediating effect of environmental dynamisms on complexity leadership and dynamic capabilities.

This section discusses the result from the hypothesis testing of the mediation. Each hypothesis are discussed separately starting with the correlation between complexity leadership and dynamic capabilities.

6.6.1. Objective 1: Complexity leadership and dynamic capabilities

Findings

The purpose of the first objective was to determine if there is a positive relationship between complexity leadership and dynamic capabilities. The findings showed a positive and statistically significant correlations between the two constructs; complexity leadership explained 66% of the total variance in dynamic capabilities. The null hypothesis was rejected, and the alternative hypothesis accepted.

These results mean the there is a correlation between complexity leadership and dynamic capabilities. As much as a low level of complexity leadership can be associated

with a low level of dynamic capabilities, the inverse is true.

Literature comparison

Complexity leadership advocates for using a triad leadership model (operating, entrepreneurial, and enabling leadership) for creating an ambidextrous leadership that uses adaptive space to facilitate the adaptive space. Wohlgemuth et al., (2019) highlighted the importance of seeking a leadership mechanism that facilitated flexibility, employee participation across all echelons and facilitate adaptability and the creation and modification of dynamic capabilities. Employee participation and informal control was highlighted as antecedents to dynamic capabilities, managerial trust in employee and informal control facilitated employees participation. In support, Eisenhardt & Martin (2000) advocated for a flexible leadership that can influence dynamic capabilities, and Uhl-Bien & Arena (2018) suggested complexity leadership offered the solution and desired leadership.

Dynamic capabilities require intentionality in “integrate, build, and reconfigure internal and external competences to address rapidly changing environments” (Teece et al., 1997, p. 516). The role of leadership, employee participation and social capital in creating routines and capabilities to build and change capabilities in multi-context environments is an essential component of dynamic capabilities (Ambrosini et al., 2009; Makkonen et al., 2014; Rodrigo-Alarcón et al., 2018; Schilke et al., 2018; Teece et al., 1997; Wohlgemuth et al., 2019). Implementing dynamic capabilities requires managerial leadership with entrepreneurial thinking, cognitive ambidexterity, and appreciation for contextual intelligence to deploy the capabilities given the context (Augier & Teece, 2009; Helfat & Peteraf, 2015; Schilke et al., 2018). Complexity leadership supports dynamic capabilities.

The findings of this research paper support the role of complexity leadership as a leadership mechanism for leveraging dynamic capabilities. Complexity leadership explained 66% of the total variance in dynamic capabilities. This suggests that complexity leadership had a strong correlation with dynamic capabilities. This supports the findings that informal control and employee participation support the development and harnessing of dynamic capabilities (Wohlgemuth et al., 2019). In addition, dynamic capabilities is organisation wide process and requires leadership the supports developing networks and collective intelligence (Wohlgemuth et al., 2019). Using adaptive space and an ambidextrous leadership model, complexity leadership supports harnessing dynamic capabilities; it facilitates both exploitation and exploration using leadership traits across all echelons.

6.6.2. Objective 2: Complexity leadership and environmental dynamism

Findings

The purpose of the second object was to determine whether there was a positive relationship between complexity leadership and environmental dynamism. The findings showed a positive and statistically significant correlations between the two constructs; complexity leadership explained 7% of the variance in environmental dynamism. The null hypothesis was rejected, and the alternative hypothesis accepted.

These results mean the there is a correlation between complexity leadership and environmental dynamism. As much as a low level of complexity leadership can be associated with a low level of environmental dynamisms, the inverse is true. It explains up to 7% of the variance in environmental dynamism.

Literature comparison

Organisations facing dynamic environments can succeed when they are ambidextrous; when they simultaneously adapt to new routines, explore new opportunities and novelty while seeking efficiency, exploiting existing resources and pursing performance (Gibson & Birkinshaw, 2004). Complex adaptive systems view suggests that unstable systems (highly chaotic) cannot maintain their state and fail because of low levels of adaptability and evolutability; whereas highly ordered systems (stable) are too rigid to coordinate new behaviours and likewise fail when faced with an adaptive challenge (Schneider & Somers, 2006). Poised systems, those at the edge of chaos between order and disorder, are adaptable owing to have a high interconnectivity between agents and are able to navigate between stabilising and destabilising elements (Rickles et al., 2007; Schneider & Somers, 2006; Uhl-Bien & Arena, 2017).

Environmental dynamism creates complexity and instability, it facilitates the creation of poised systems and the shift towards the edge of chaos (Dess & Beard, 1984; Hannah et al., 2009; Osborne & Hinson, 2011; Schneider & Somers, 2006). Dramatic social change introduces a wider and multi-layered dynamism and thus increases environmental dynamism (de la Sablonnière, 2017). Complexity leadership offers adaptive space and a leadership model to facilitate adaptability in the face of increasing complexity and environmental dynamisms. It advocates for playing in the pressure and engaging conflict arising from internal and external environmental dynamics (Uhl-Bien &

Arena, 2017, 2018).

Findings of this research paper supports the correlation between complexity leadership and environmental dynamism. Complexity leadership actions are positively associated with the rate of environmental dynamism, supporting adaptability in increasing dynamic contexts. An increase in dynamism increases complexity leadership actions and vice versa. Jansen et al. (2009) found that leadership actions were impactful under conditions of environmental dynamisms. At the edge of chaos, complexity facilitates adaptability by advocating the use of multi-agent leadership model that facilitate networked interaction and contextual intelligence. This supports the findings by Surty & Scheepers (2020), leadership practices were positively impacted by environmental dynamism, stimulating employees' responsiveness to change. Complexity leadership supports the need to cope with dynamic environments by simultaneously seek stability and novelty, exploration and exploitation-they are ambidextrous (Gibson & Birkinshaw, 2004; Uhl-Bien & Arena, 2018). This supports the call by Osborn et al. (2011) that when leadership should move to multi-directional influence, collective intelligence, building network connection in response to increasing complexity and dynamism.

6.6.3. Objective 3: Environmental dynamism and dynamic capabilities

Findings

The purpose of the second object was to determine whether there was a positive relationship between environmental dynamism and dynamic capabilities. The findings showed a positive and statistically significant correlations between the two constructs, environmental dynamism explained 3% of variance in dynamic capabilities. The null hypothesis was rejected, and the alternative hypothesis accepted.

These results mean the there is a correlation between environmental dynamism and dynamic capabilities. As much as a low level of environmental dynamism can be associated with a low level of dynamic capabilities, the inverse is true.

Literature comparison

Organisation that drive adaptability can manage the tension from the need for exploration and exploitation driven by dynamic environments. Dynamic capabilities offers a guiding framework on how to manage and address complexities arising from environmental

dynamism (Eisenhardt & Martin, 2000; Makkonen et al., 2014; Teece et al., 1997). An increase in environmental dynamism induces firms to deploy dynamic capabilities in response and thus adapt.

Literature on dynamic capabilities focuses on the changes in the competitive environment (Eisenhardt & Martin, 2000; Makkonen et al., 2014; Teece et al., 1997) as a driver of adaptive actions. Environmental dynamisms induces complexity, which induces the need for adaptability; dynamic capability enables firms to build, modify, and reconfigure internal and external competencies in response to complexity (Duncan, 1972; Jansen et al., 2006; Makkonen et al., 2014; Teece et al., 1997). Dynamic capabilities are suitable for varying environmental context and thus can be deployed in stable, dynamic and hyper environments (Ambrosini et al., 2009; Makkonen et al., 2014; Schilke et al., 2018).

Findings of this research paper support the correlation between environmental dynamism and dynamic capabilities. Dynamism has a positive influence on dynamic capabilities and the type of capabilities used to respond. Environmental dynamisms is an important antecedent to dynamic capabilities (Ambrosini et al., 2009; Makkonen et al., 2014; Schilke et al., 2018).

6.6.4. Objective 4: Environmental dynamism as mediator

Findings

The purpose of the fourth object was to determine whether environmental dynamism had a mediating effect on the relationship between complexity leadership and dynamic capabilities. The findings showed environmental dynamism partially mediated the relationship between complexity leadership and dynamic capabilities. The direct effects between complexity leadership and dynamic capabilities were significant (P = 0.001) with the coefficient is 0.810, the indirect effects were significant (P = 0.000) with a coefficient of 0.050. The results showed effects were both direct and indirect (and significant) hence the partial mediation results. The null hypothesis was rejected, and the alternative hypothesis accepted.

The results mean that there is a significant correlation between complexity leadership and dynamic capabilities directly and through the environmental dynamism (Baron & Kenny, 1986; Hair et al., 2019). Environmental dynamism creates conditions conducive for the correlation between complexity leadership and dynamic capabilities, it acts as a facilitator. However, as an intervening variable, environmental dynamism does

not explain the full correlation between complexity leadership and dynamic capabilities because there is still a significant direct relationship. This means in the absence of environmental dynamism, there is still a significant relationship between the two constructs (Baron & Kenny, 1986; Hair et al., 2019). Complexity leadership and dynamic capabilities have a direct relationship that is not influenced by conditions created by environmental dynamism.

Literature comparison

The ability to convert a crisis into an opportunity depends on the organisation's abilities to manage its impact and weather the storm (Ritter & Pedersen, 2020). At the heart of complexity leadership and dynamic capabilities is the need for adapting to increasingly complexity and dynamic external environment (Schilke et al., 2018; Teece et al., 1997; Uhl-Bien & Arena, 2018). In a South Africa, Surty & Scheepers (2020) found the environmentally dynamisms created an opportunity for leaders to harvest responses to change. This is further supported by the notion that adaptability is more likely at the edge of chaos, suggesting environmental dynamism facilitated adaptability (Schneider & Somers, 2006). Adapting to dynamic environments requires a leadership model supportive of the need intentionally driving the creation and modification of internal and external capabilities (Augier & Teece, 2009; Uhl-Bien & Arena, 2018).

Complexity theory advocates that environmental dynamism creates poised systems (and agent), those at the edge of chaos between order and disorder; poised systems are adaptable owing to have a high interconnectivity between agents and the ability to navigate between stabilising and destabilising elements (Rickles et al., 2007; Schneider & Somers, 2006; Uhl-Bien & Arena, 2017). Complexity leadership advocate for using multi-layered leadership, recognising leadership is embedded in routines and action of many agents' organisational network. Dynamic capabilities advocate for using managers intentional actions and the wider organisational network by advocating for broader employee participation (Augier & Teece, 2009; Pitelis & Wagner, 2019; Wohlgemuth et al., 2019). However, complexity leadership offers leadership able to manage operational demands and performance requires (operational leadership) and not only entrepreneurial leadership. Complexity leadership facilitates both exploration and exploitation. Dynamic capabilities is context specific, in stable environments incremental capabilities are deployed whereas in hypercompetitive environments regenerative capabilities are deployed (Ambrosini et al., 2009; Makkonen et al., 2014; Schilke et al., 2018). This suggests that both complexity leadership and dynamic capabilities support varying degrees of dynamisms.

The results of this research paper found environmental dynamisms partial mediated the interaction between complexity leadership and dynamic capabilities. This means complexity leadership and dynamic capabilities are positively corrected in the presence and absence of environmental dynamism. This supports the literature that suggests dynamic capabilities can exist in varying decrease of dynamism, stable and unstable (Makkonen et al., 2014; Schilke, 2014). And that complexity leadership supports both stability and seeking change (Uhl-Bien & Arena, 2018). Schilke et al. (2018) advised that dynamic capabilities should not be viewed as synonymous with environmental dynamisms. Kachouie et al. (2018) found that dynamic capabilities can induce market change not used only to respond to change. Complexity leadership advocate for playing in the pressure, meaning instability can be internally induced to stimulate change (Uhl-Bien & Arena, 2018)

6.7. Summary of findings

The findings of this paper found support for the positive correlations between complexity leadership, dynamic capabilities and environmental dynamism The mediation effects found environmental dynamism partially mediated the interaction complexity leadership has with dynamic capabilities.

The implication for business, limitation and recommendations are outlined in the following chapter

7. Conclusion

This chapter highlights the research findings and encompasses the theoretical contribution, implications for practice, recommendations for future research and limitation.

7.1. Overview of the results

This study was conducted with four objectives as its pillar but ultimately sought to confirm whether environmental dynamism mediated the interaction between complexity leadership and dynamic capabilities. The results of the study found:

- The relationship complexity leadership has with dynamic capabilities is positive and significant. Complexity leadership is an antecedent of dynamic capabilities.
- The relationship complexity leadership has with environmental dynamism is positive and significant. Complexity leadership traits are positively associated with the degree of environmental dynamism.
- The relationship dynamic capabilities has with environmental dynamism is positive and significant. Environmental dynamism is an antecedent to dynamic capabilities.
- Environmental dynamism had a partial mediating effect on the relationship complexity leadership has with dynamic capabilities. Environmental dynamisms facilitated the interaction between complexity leadership and dynamic capabilities but there was a direct interaction its absence.

7.2. Theoretical implications

The paper explored the mediating effect of environmental dynamism on complexity leadership and dynamic capabilities as the primary purpose. The finds contribute empirical evidence to literature that suggests complexity leadership and dynamic capabilities were fit for providing a mechanism for managing complexity and dynamism (Uhl-Bien & Arena, 2018).

The research was conducted using a novel scale measuring complexity leadership (Diesel & Scheepers, 2019) as a second-order construct. The exploratory factor analysis was conducting and extracted three separate factors measuring patterning attention, contextual intelligence, and developing networks. The results of the

first-order confirmatory factory analysis showed a significant correlation between the constructs and supported the use of complexity leadership as a second-order construct explaining the correlation between patterning attention, contextual intelligence, and developing networks. As first-order construct, they loaded significantly on complexity leadership.

The role environmental dynamism plays in creating conditions suitable for adaptability using complexity leadership as the leaders mechanism and dynamic capabilities to guide resource renewal routines and processes was support with empirical evidence (Uhl-Bien & Arena, 2018). The call by Schilke et al. (2018) that environmental dynamism was not a precondition for dynamic capabilities is supported further because the findings illustrated that complexity leadership had a relationship with dynamic capabilities in the absence of environmental dynamism. However, mediating effect was only partial. This means the absence of environmental dynamisms does not prevent the relationship complexity leadership has with dynamic capabilities.

7.3. Implication for business

The finds of this paper can be used to make practical interventions to support organisational adaptability.

The research results show complexity leadership can be used when unleashing dynamic capabilities to manage the complexity and dynamism leaders and organisations are facing today (Osborne & Hinson, 2011; Uhl-Bien & Arena, 2018). Complexity leadership advocates for inclusive leadership while supporting exploration and exploitation activities, and managing the conflict emerging from the two approaches. It supports creating adaptive space (conditions) that support diverse views, learning, effective communication, and developing and deploying new ideas and innovation their into the organisational system as the novel ways of doing things. As complexity increases, leadership requires more adaptive approaches to managing the increasing complex decision-making and leading change. Command-and-control is ill-suited for every increasingly complex world we are facing (Uhl-Bien & Arena, 2017, 2018).

Complexity leadership activities, processes and traits advocate for developing network (internally and externally), using social capital, team work, constructive conflicting and developing group cohesion (Kutz, 2008; Marion & Uhl-Bien, 2001; Uhl-Bien & Arena, 2017, 2018). Organisation can use adaptive space to manage the tensions from creating efficiencies and pursuing performance goals while seeking to innovate and

experiment (Gibson & Birkinshaw, 2004; Uhl-Bien & Arena, 2018). Complexity leadership facilitates the creation of cognitive ambidexterity (Meynhardt et al., 2017). Complexity leadership offers a suitable framework from dynamic capabilities in stable and dynamic environments. Managers can use complexity leadership to harvest environmental dynamism and dramatic social change induced by COVID-19.

Leaders need to know how to operationalise dynamic capabilities and how the different dimensions affect the resource base. This occurs while considering firm-specific context, its operating capabilities, and the managerial and organisational level where it is implemented. Complexity leadership offers a managerial framework for implementing dynamic capabilities.

7.4. Research limitations of research and future research recommendation

The limitations of this research are driven by the method used to conduct the study.

The first limitation of the study is the sampling method. The study was conducted using convenience sampling and snowballing. Using a convenience and snowballing sampling (non-probability sampling) introduces the risk of sampling error because individuals and organisations sampled had a better likelihood of being selected. In contrast, probability sampling uses a random selection approach that increases the likelihood that each sample in the population could be selected for testing (Bell et al., 2019; Bryman & Bell, 2011). As a result, probability sampling minimises sampling error.

The cross-sectional data collection approach does not permit measuring change and trends over time because it provides a snapshot at a point in time. Future studies should take a longitudinal approach. As Rindfleisch et al. (2008) notes, a longitudinal study "would help untangle causal relationships" between constructs and provide rich data that considers the rate and direction of change in the environment, and its impact (p.264).

Contexts and dynamism were important for this study. As a South Africa limited study, applicability of the findings cannot be generalised to other countries or all countries. Future studies should consider a multi-country approach to strengthen or challenge the generalisability of the findings. In addition, future studies should target stable environments, industries and other contexts to test the variability or similarities to these findings.

Complexity leadership is not yet a fully developed theory, future studies would benefit from conducting a mixed method approach to supplement this quantitative approach. This would enrich complexity leadership literature and yield further insights.

Future research should explore adaptive space, and the processes involved in managing conflicting and connecting. Adaptive space is conditions created to facilitate adaptation. Insights into how they are created and sustained can enrich complexity leadership.

Enabling leadership supports adaptability by facilitating the creation of adaptive space. Future research should study mechanisms of measuring performance outcomes of enabling leadership and incentive mechanisms.

7.5. Conclusion

Leadership is not a role, but actions enacted regularly. This study aimed to understand the mediating role of environmental dynamisms in the relationship complexity leadership has with dynamic capabilities. It found environmental dynamisms partially influences the relationship. Complexity leadership is conducive for creating, modify and reconfiguring internal and external competences; it supports the creation and modification of dynamic capabilities in line with literature (Uhl-Bien & Arena, 2018).

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9. APPENDEX 1: MEASUREMENT INSTRUMENT

Construct	Scale	Scale developed by
Independent Variable (Predictors or called Antecedents)		
Complexity leadership (19 item scale)		
Patterning attention	1. Facilitates dialog and discussion to help employees share knowledge in developing a shared understanding of issues. 2. Initiates discussions on what is important, not what to do and how to do it. 3. Connects employees with a broad variety of potential information sources, such as those people with relevant information. 4. Injects ideas and information into the system for it to process to create energy for change. 5. Tells stories to illustrate important learning points. 6. Encourages employees to raise difficult and challenging questions that others may perceive as a threat to the status quo.	(Osborn et al., 2002)
Developing networks	1. Creates linkages between entities inside the organisation and with outside stakeholders. 2. Has political skill of sizing up group politics for the benefit of the department or business unit. 3. Displays political savvy in understanding the interests of the other players in organisational networks. 4. Builds networks across internal organisational boundaries/ silos or	(Osborn & Marion, 2009)

	functions. 5. Embraces diversity by having diverse people and views as part of the network. 6. Gathers feedback information from external stakeholders such as suppliers and customers to improve the organisation.	
Contextual Intelligence	1. Gathers intelligence from what is happening in the context like which threats and opportunities are developing. 2. Demonstrates being in tune with the organisational and external environment or context. 3. Frames our change projects in ways that appeal or speaks to the interest of particular stakeholders. 4. Adapts his/her communication to different ethnic cultures in the organisation. 5. Investigates relevant contextual variables that are or might influence the organisation. 6. Has a forward-looking mentality - sense of direction for where the organisation is going in the future. 7. Provide opportunities for diverse employees to interact in a non-discriminatory manner.	(Kutz, 2008)
Dependent Variable (Criteria or called Consequences)		
Dynamic capabilities (21 items scale)		
Renewing capabilities		
Sensing and seizing	1. We systematically search for new business concepts through observation of	(Makkonen et al.,

	processes in the environment. 2. We systematically bring together creative and knowledgeable persons within the firm to identify new business opportunities. 3. We systematically bring together creative and knowledgeable persons from outside the firm to help identify new business opportunities. 4. Our firm systematically transfers resources to the development of new business activities.	2014)
Knowledge creation	1. We seek to increase R&D investments. 2. Our firm has specific plans for R&D activity. 3. Our management promotes R&D processes 4. We are developing routines for firm R&D.	
Knowledge Integration	1. The firm uses networks as knowledge resources. 2. The firm exploits the personal network of the manager. 3. Employees' networks are important information sources for the firm. 4. The firm uses networks to influence actors in the environment	
Regenerative capabilities		
Reconfiguration	1. We have developed routines to enable employees' active participation in generating ideas for new products or services. 2. We have developed routines to enable employees' active participation in generating ideas for new production processes or organizational procedures. 3. The firm has routines for systematizing employees' experiences.	(Makkonen et al., 2014)
Leveraging	1. Our employees are more willing to adopt new ways of working than those of	

	our competitors. 2. Employees have room to exploit new opportunities as long as it does not affect current activities. 3. The firm strongly encourages employees and managers to promote new visions, goals and ideas.	
Learning	1. The firm emphasizes the need to increase the level of competence among employees. 2. The firm allocates resources to increasing employees' competence. 3. The firm strongly encourages employees to learn from their experiences.	
Environmental dynamism		
Environmental dynamism	1. Environmental changes in our local market are intense. 2. Our clients regularly ask for new products and services. 3. In our local market, changes are taking place continuously. 4. In a year, nothing has changed in our market. 5. In our market, the volumes of products and services to be delivered change fast and often.	(Jansen et al., 2006)

10. APPENDX B: ETHICS CLEARENCE LETTER

Mon, 7 Sep 2020 at 16:54

Gordon Institute of Business Science
University of Pretoria

1. Ethical Clearance Approved

Dear Nduvho Kutama,

Please be advised that your application for Ethical Clearance has been approved.
You are therefore allowed to continue collecting your data.
We wish you everything of the best for the rest of the project.

Ethical Clearance Form

Kind Regards

APPENDEX C: QUESTIONNAIRE

Participants' consent

Dear respondent

Introduction and purpose

I am a Master in Philosophy in Corporate Strategy (MPhil CS) student at the University of Pretoria's Gordon Institute of Business Science (GIBS).

I am conducting research on the relationship between complexity leadership and dynamic capabilities. The potential benefits of this research includes reducing an existing gap in academic literature and providing organisations with a framework that could improve leadership behaviour and increase their competitive advantage. You are invited to contribute by participating in the survey.

Rights and confidentiality

Your participation in this research study is voluntary, anonymous, and confidential. I do not have access to any of your personal identifying information, and you may end your participation at any time without a penalty. Your assistance will take no more than 20 minutes of your time. The survey will guide you through the process, collect your responses, and the completed survey data will be forwarded to me for reporting as a total and not individualised. I offer no monetary compensation for your participation.

By completing the survey you indicate that you are voluntarily participating in this research. You may select to terminate your participation at any time and for any reason. If you have questions about this survey, please contact me or my supervisor.

Researcher's name: Nduvho Kutama
Email: 19407468@mygibs.co.za; Phone: +27 72 400 1951

Research supervisor: Thea Pieterse
Email: theap@gold.co.za; Phone: + 27 82 891 8207

Thank you very much for your participation in this study. I appreciate your time and help.

Complexity Leadership

Q1. Facilitates dialog and discussion to help employees share knowledge in developing a shared understanding of issues.
Q2. Initiates discussions on what is important, not what to do and how to do it
Q3. Connects employees with a broad variety of potential information sources such as those people with relevant information
Q4. Injects ideas and information into the system for it to process to create energy for change
Q5. Tells stories to illustrate important learning points
Q6. Encourages employees to raise difficult and challenging questions that others may perceive as a threat to the status quo
Q7. Creates linkages between entities inside the organisation and with outside stakeholders
Q8. Has political skill of sizing up group politics for the benefit of the department or business unit.
Q9. Displays political savvy in understanding the interests of the other players in organisational networks.
Q10. Builds networks across internal organisational boundaries/ silos or functions.
Q11. Embraces diversity by having diverse people and views as part of the network
Q12. Gathers feedback information from external stakeholders such as suppliers and customers to improve the organisation
Q13.Gathers intelligence from what is happening in the context like which threats and opportunities are developing
Q14. Demonstrates being in tune with the organisational and external environment or context
Q15. Frames our change projects in ways that appeal or speaks to the interest of particular stakeholders
Q16. Adapts his/her communication to different ethnic cultures in the organisation
Q17. Investigates relevant contextual variables that are or might influence the organisation
Q18. Has a forward-looking mentality - sense of direction for where the organisation is going in the future
Q19. Provide opportunities for diverse employees to interact in a non-discriminatory manner

Dynamic Capabilities

Q20. We systematically search for new business concepts through observation of processes in the environment.
Q21. We systematically bring together creative and knowledgeable persons within the firm to identify new business opportunities.
Q22. We systematically bring together creative and knowledgeable persons from outside the firm to help identify new business opportunities.
Q23. Our firm systematically transfers resources to the development of new business activities.
Q24. We seek to increase research and development (R&D) investments
Q25. Our firm has specific plans for R&D activity
Q26. Our management promotes R&D processes
Q27. We are developing routines for firm research and development (R&D)
Q28. The firm uses networks as knowledge resources
Q29. The firm exploits the personal network of the manager
Q30. Employees' networks are important information sources for the firm
Q31. The firm uses networks to influence actors in the environment
Q32. We have developed routines to enable employees' active participation in generating ideas for new products or services.
Q33. We have developed routines to enable employees' active participation in generating ideas for new production processes or organizational procedures
Q34. The firm has routines for systematizing employees' experiences
Q35. Our employees are more willing to adopt new ways of working than those of our competitors
Q36. Employees have room to exploit new opportunities as long as it does not affect current activities
Q37. The firm strongly encourages employees and managers to promote new visions, goals and ideas
Q38. The firm emphasizes the need to increase the level of competence among employees
Q39. The firm allocates resources to increasing employees' competence
Q40. The firm strongly encourages employees to learn from their experiences

Environmental dynamism

Q41. Environmental changes in our local market are intense
Q42. Our clients regularly ask for new products and services
Q43. In our local market, changes are taking place continuously
Q44. In a year, nothing has changed in our market
Q45. In our market, the volumes of products and services to be delivered change fast and often

Biographical Questions

Q46. Gender
Q47. Race group
Q48. Age
Q49. What is your level of education?
Q50.How many years have you worked for this organisation?
Q51. At which level in the organisation are employed?
Q52. In which discipline are you employed?

Organisational demographics

Q53. Is your organisation predominately bureaucratic or entrepreneurial?
Q54. How many employees does your organisation have?
Q55. For how many years has your organisation been conducting business
Q56. What is your organisation's primary business activity?
Q57. What is the last reported annual revenue for your organisation?

Table 18 Outliers

Observations farthest from the centroid (Mahalanobis distance)							
Observation number	**Mahalanobis d-squared**	**P1**	**P2**	**Observation number**	**Mahalanobis d-squared**	**P1**	**P2**
1	226.662	0.000	0.000	**28**	96.629	0.000	0.000
988	173.17	0.000	0.000	**1010**	96.431	0.000	0.000
771	152.086	0.000	0.000	**96**	96.29	0.000	0.000
960	149.769	0.000	0.000	**737**	95.905	0.000	0.000
756	139.184	0.000	0.000	**190**	95.328	0.000	0.000
168	137.27	0.000	0.000	**76**	95.126	0.000	0.000
4	133.44	0.000	0.000	**469**	94.786	0.000	0.000
587	132.214	0.000	0.000	**833**	94.54	0.000	0.000
392	131.341	0.000	0.000	**594**	93.961	0.000	0.000
891	130.671	0.000	0.000	**706**	93.779	0.000	0.000
980	128.957	0.000	0.000	**548**	93.767	0.000	0.000
757	124.568	0.000	0.000	**591**	92.768	0.000	0.000
282	121.049	0.000	0.000	**859**	92.634	0.000	0.000
791	119.271	0.000	0.000	**262**	91.641	0.000	0.000
892	115.354	0.000	0.000	**513**	90.66	0.000	0.000
433	112.412	0.000	0.000	**306**	90.175	0.000	0.000
340	110.86	0.000	0.000	**283**	89.943	0.000	0.000
558	110.266	0.000	0.000	**699**	89.939	0.000	0.000
66	109.904	0.000	0.000	**34**	88.934	0.000	0.000
1017	107.587	0.000	0.000	**900**	88.824	0.000	0.000
604	107.089	0.000	0.000	**185**	88.68	0.000	0.000
1020	106.915	0.000	0.000	**113**	88.43	0.000	0.000
754	106.88	0.000	0.000	**44**	88.402	0.000	0.000
231	104.446	0.000	0.000	**358**	87.785	0.000	0.000
957	104.226	0.000	0.000	**398**	87.663	0.000	0.000
476	103.665	0.000	0.000	**503**	87.183	0.000	0.000
239	102.847	0.000	0.000	**175**	86.799	0.000	0.000
829	100.229	0.000	0.000	**123**	86.262	0.000	0.000
954	99.503	0.000	0.000	**35**	85.73	0.000	0.000
418	98.721	0.000	0.000	**994**	85.723	0.000	0.000
639	98.024	0.000	0.000	**261**	84.939	0.000	0.000
135	97.961	0.000	0.000	**250**	84.516	0.000	0.000
6	97.831	0.000	0.000	**519**	84.207	0.000	0.000
782	97.788	0.000	0.000	**821**	83.975	0.000	0.000
136	97.569	0.000	0.000	**516**	83.661	0.000	0.000
784	97.187	0.000	0.000	**390**	83.129	0.000	0.000

Z-score Descriptive Statistics									
	N	Minimum	Maximum	Mean	Std. Deviation	Skewness		Kurtosis	
	Statistic	Statistic	Statistic	Statistic	Statistic	Statistic	Std. Error	Statistic	Std. Error
Zscore: PA1	953	-2.45	1.35	0.000	1.000	-0.464	0.079	-0.321	0.158
Zscore: PA2	953	-2.30	1.40	0.000	1.000	-0.356	0.079	-0.603	0.158
Zscore: PA3	953	-2.08	1.34	0.000	1.000	-0.288	0.079	-0.802	0.158
Zscore: PA4	953	-2.11	1.46	0.000	1.000	-0.298	0.079	-0.692	0.158
Zscore: PA5	953	-1.80	1.44	0.000	1.000	-0.152	0.079	-0.939	0.158
Zscore: PA6	953	-1.58	1.35	0.000	1.000	-0.142	0.079	-1.221	0.158
Zscore: DN1	953	-1.91	1.40	0.000	1.000	-0.295	0.079	-0.826	0.158
Zscore: DN2	953	-1.51	1.69	0.000	1.000	0.131	0.079	-0.972	0.158
Zscore: DN3	953	-1.76	1.57	0.000	1.000	-0.106	0.079	-0.864	0.158
Zscore: DN4	953	-2.14	1.30	0.000	1.000	-0.436	0.079	-0.646	0.158
Zscore: DN5	953	-2.14	1.16	0.000	1.000	-0.476	0.079	-0.748	0.158
Zscore: DN6	953	-2.11	1.23	0.000	1.000	-0.416	0.079	-0.775	0.158
Zscore: CI1	953	-2.37	1.20	0.000	1.000	-0.559	0.079	-0.463	0.158
Zscore: CI2	953	-2.42	1.28	0.000	1.000	-0.520	0.079	-0.393	0.158
Zscore: CI3	953	-2.34	1.55	0.000	1.000	-0.371	0.079	-0.343	0.158
Zscore: CI4	953	-1.85	1.32	0.000	1.000	-0.306	0.079	-0.933	0.158
Zscore: CI5	953	-2.31	1.43	0.000	1.000	-0.422	0.079	-0.406	0.158
Zscore: CI6	953	-2.45	0.97	0.000	1.000	-0.848	0.079	-0.172	0.158
Zscore: CI7	953	-2.15	1.12	0.000	1.000	-0.573	0.079	-0.631	0.158
Zscore: DCOBS1	953	-2.68	1.19	0.000	1.000	-0.942	0.079	0.175	0.158
Zscore: DCOBS2	953	-2.49	1.16	0.000	1.000	-0.885	0.079	-0.153	0.158
Zscore: DCOBS3	953	-2.24	1.35	0.000	1.000	-0.662	0.079	-0.488	0.158
Zscore: DCOBS4	953	-2.47	1.29	0.000	1.000	-0.799	0.079	-0.181	0.158
Zscore: DCREN1	953	-2.07	1.22	0.000	1.000	-0.563	0.079	-0.793	0.158
Zscore: DCREN2	953	-2.06	1.30	0.000	1.000	-0.560	0.079	-0.697	0.158
Zscore: DCREN3	953	-2.12	1.31	0.000	1.000	-0.599	0.079	-0.613	0.158
Zscore: DCREN4	953	-2.05	1.41	0.000	1.000	-0.483	0.079	-0.749	0.158
Zscore: DCACQ1	953	-2.79	1.22	0.000	1.000	-0.893	0.079	0.247	0.158
Zscore: DCACQ2	953	-2.14	1.56	0.000	1.000	-0.370	0.079	-0.677	0.158
Zscore: DCAQC3	953	-2.24	1.23	0.000	1.000	-0.707	0.079	-0.442	0.158
Zscore: DCAQC4	953	-2.36	1.44	0.000	1.000	-0.604	0.079	-0.335	0.158
Zscore: DCREC4	953	-2.25	1.32	0.000	1.000	-0.638	0.079	-0.480	0.158
Zscore: DCREC5	953	-2.19	1.39	0.000	1.000	-0.588	0.079	-0.630	0.158
Zscore: DCREC6	953	-2.14	1.49	0.000	1.000	-0.466	0.079	-0.733	0.158
Zscore: DCREN8	953	-2.30	1.30	0.000	1.000	-0.646	0.079	-0.397	0.158
Zscore: DCREN9	953	-2.26	1.32	0.000	1.000	-0.671	0.079	-0.466	0.158
Zscore: DCREN10	953	-2.19	1.17	0.000	1.000	-0.746	0.079	-0.464	0.158
Zscore: DCREC1	953	-2.81	1.03	0.000	1.000	-1.140	0.079	0.724	0.158
Zscore: DCREC2	953	-2.49	1.13	0.000	1.000	-0.967	0.079	0.153	0.158
Zscore: DCREC3	953	-2.97	1.01	0.000	1.000	-1.151	0.079	0.815	0.158
Zscore: ED1	953	-3.25	0.97	0.000	1.000	-1.250	0.079	1.189	0.158
Zscore: ED2	953	-2.73	1.22	0.000	1.000	-0.850	0.079	0.130	0.158
Zscore: ED3	953	-3.55	0.95	0.000	1.000	-1.340	0.079	1.562	0.158
Zscore: ED4	953	-2.48	0.91	0.000	1.000	-0.999	0.079	-0.125	0.158
Zscore: ED5	953	-2.73	1.20	0.000	1.000	-0.853	0.079	0.093	0.158

Table 19 Z-score Descriptive Statistics

Table 20 Descriptive statistics

Discipline					
		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Finance	233	24.4	24.4	24.4
	Human resource	56	5.9	5.9	30.3
	Information Technology	103	10.8	10.8	41.1
	Marketing	37	3.9	3.9	45.0
	Operations	152	15.9	15.9	61.0
	Projects	76	8.0	8.0	68.9
	Research and development	52	5.5	5.5	74.4
	Sales	70	7.3	7.3	81.7
	Others	174	18.3	18.3	100.0
	Total	953	100.0	100.0	

Number of employees					
		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	1 - 50	182	19.1	19.1	19.1
	51 -100	69	7.2	7.2	26.3
	101 - 200	64	6.7	6.7	33.1
	201 - 500	93	9.8	9.8	42.8
	501 - 1000	131	13.7	13.7	56.6
	1001 +	414	43.4	43.4	100.0
	Total	953	100.0	100.0	

Age of organisation					
		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	0 - 2 years	30	3.1	3.1	3.1
	3 - 5 years	61	6.4	6.4	9.5
	6 - 10 years	88	9.2	9.2	18.8
	11 - 20 years	147	15.4	15.4	34.2
	21 - 50 years	234	24.6	24.6	58.8
	50 + years	393	41.2	41.2	100.0
	Total	953	100.0	100.0	

Value of last reported annual revenue					
		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	0 - R1 000 000	85	8.9	8.9	8.9
	R1 000 001 - R5 000 000	79	8.3	8.3	17.2
	R5 000 001 - R10 000 000	62	6.5	6.5	23.7
	R10 000 001 - R50 000 000	105	11.0	11.0	34.7
	R50 000 001 - R100 000 000	121	12.7	12.7	47.4
	R100 000 000 +	501	52.6	52.6	100.0
	Total	953	100.0	100.0	

Organisation's primary business activity					
		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Advertising & Marketing	20	2.1	2.1	2.1
	Agriculture	16	1.7	1.7	3.8
	Airlines & Aerospace (including Defense)	6	0.6	0.6	4.4
	Automotive	20	2.1	2.1	6.5
	Business Support & Logistics	28	2.9	2.9	9.4
	Construction, Machinery, and Homes	18	1.9	1.9	11.3
	Education	65	6.8	6.8	18.2
	Engineering	49	5.1	5.1	23.3
	Entertainment & Leisure	16	1.7	1.7	25.0
	Financial Services	90	9.4	9.4	34.4
	Financial services/Banking	76	8.0	8.0	42.4
	Financial Services/Insurance	26	2.7	2.7	45.1
	Food & Beverages	27	2.8	2.8	48.0
	Government	80	8.4	8.4	56.3
	Healthcare & Pharmaceuticals	34	3.6	3.6	59.9
	Insurance	6	0.6	0.6	60.5
	Manufacturing	47	4.9	4.9	65.5
	Nonprofit	16	1.7	1.7	67.2
	Retail & Consumer Durables	17	1.8	1.8	68.9
	Real Estate	5	0.5	0.5	69.5
	SOC - State owned entity	47	4.9	4.9	74.4
	Telecommunications, Technology, Internet & Electronics	75	7.9	7.9	82.3
	Transportation & Delivery	19	2.0	2.0	84.3
	Utilities, Energy, and Extraction	32	3.4	3.4	87.6
	Other	118	12.4	12.4	100.0
	Total	953	100.0	100.0	