Gordon Institute of Business Science
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Organisational innovation climate as a mediator of the relationship between complexity leadership and contextual ambidexterity

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ABSTRACT

Organisations today face the challenge of efficiency in the management of today's business demands, the search for new opportunities and to deal with complexity. Organisations need to be innovative to survive and succeed: leaders need to drive contextual ambidexterity (exploitative and exploratory innovation). The context in which a business finds itself, and creates internally, can be harnessed together with leadership to achieve these objectives.

Leadership plays a fundamental role in developing and promoting contextual ambidexterity, yet there has been limited research on the success and mediating factors., and what leadership approach can achieve this effectively. Therefore, a greater understanding of relationships between leadership and contextual ambidexterity, and mediating factors will be useful for leaders and organisations. This research investigates this: how complexity leadership and organisational innovation climate promote contextual ambidexterity.

Through SEM using 1204 secondary survey responses, the researcher investigated the relationships between complexity leadership, contextual ambidexterity and organisational innovation climate, and the mediating effect of organisational innovation climate. Results showed that the climate plays and important mediator role between complexity leadership and innovation, as well as having a significant direct effect on innovation. From these findings, organisations can gain insights into leader development and internal contextual factors that may drive contextual ambidexterity, and therefore survival and success.

KEYWORDS

Complexity leadership. "Is a new framework for leadership research and practice that describes how leaders can enable organisations to operate as complex adaptive systems – networked systems able to adapt in and evolve with a changing environment" (Uhl-Bien, & Arena, 2017, p.14).

Contextual ambidexterity. "The behavioural capacity to simultaneously demonstrate alignment and adaptability across an entire business unit" (Gibson, & Birkinshaw, 2004, p.209).

Exploitation: focuses on existing paradigms, that are refined to be more efficient (March, 1991; Raisch & Birkinshaw, 2008). Incremental innovations designed to meet existing customer needs that leads to stability, but at the risk of inertia (Lavie, Stettner, & Tushman, 2010; Raisch & Birkinshaw, 2008). The communication is top-down from higher hierarchical levels, due to the experiential learning in the organisation (Raisch & Birkinshaw, 2008).

Exploration: focuses on new alternatives, associated with experimentation, search and discovery (March, 1991; Raisch & Birkinshaw, 2008). Radical innovations to meet needs of emergent customers, thus flexibility and adaptation are required (Lavie et al., 2010; Raisch & Birkinshaw, 2008). Communication is horizontal and bottom-up from low hierarchical levels, due to experimental learning (Raisch & Birkinshaw, 2008).

Organisational innovation climate: the shared contextual perceptions individuals experience regarding the policies, practices and procedures, that emerge through social interactions, and the behaviours they observe of expectations, rewards and support by the organisation (Charbonnier-Voirin, El Akremi, & Vandenberghe, 2010; B. Schneider, Ehrhart, & Macey, 2013; B. Schneider, González-Romá, Ostroff, & West, 2016; Scott & Bruce, 1994).

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 Business Administration 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.

Rick Diesel

6/11/2017

Table of Contents

LIST OF FIGURES

LIST OF TABLES

1. DEFINITION OF PROBLEM & PURPOSE

1.1. INTRODUCTION

Organisations are faced with the challenge to be efficient in the management of today's business demands, search for new opportunities, and be adaptive enough to deal with the changing context of the landscape (Floyd & Lane, 2000; Gibson & Birkinshaw, 2004; Uhl-bien & Arena, 2017). Therefore, businesses need to be innovative: aligned and efficient in the current context, termed exploitative innovation, and adaptive enough to change while searching for new opportunities, termed exploratory innovation (Gibson & Birkinshaw, 2004). Organisations that successfully coordinate exploitative and exploratory innovation are termed ambidextrous (Benner & Tushman, 2015; Lavie et al., 2010)

Levinthal and March (1993) conclude that success and sustainability depend on an organisation's ability to "engage in enough exploitation to ensure the organisation's current viability and to participate in enough exploration to ensure future viability" (p. 105). The capacity to simultaneously exploit and explore across the entire organisational is termed contextual ambidexterity (Gibson & Birkinshaw, 2004).

Leaders play a fundamental role in developing and promoting contextual ambidexterity (Gibson & Birkinshaw, 2004; Raisch & Birkinshaw, 2008), yet there has been limited research on how leaders can achieve this (O'Reilly & Tushman, 2013). Therefore, a greater understanding of the relationship between leadership and ambidexterity, and factors that affect the relationship will be useful for leaders and organisations.

Today's business landscape is showing increasing aspects of uncertainty and ambiguity, as well as interdependencies, captured in the term "complexity" (Clarke, 2013; Uhl-bien & Arena, 2017). This has led to an interest in leadership theories to deal with this complexity and the context that organisations face (Dinh, Lord, Gardner, Meuser, & Liden, 2014; Havermans, Den Hartog, Keegan, & Uhl-Bien, 2015). Complexity leadership focuses on a model that enables leadership in a complex system by enabling it to adapt to changes within that system (Uhl-Bien, Marion, & McKelvey, 2007). Thus complexity leadership may assist leaders to enable contextual ambidexterity (Clarke, 2013).

The influencing factors must be considered to understand this relationship of complexity leadership and contextual ambidexterity. These factors relate to the context of the organisation and include the organisational innovation climate that the leader creates (Jaiswal & Dhar, 2015). Innovation climate has been shown to be an antecedent for contextual ambidexterity

(Cerne, Jaklic, & Skerlavaj, 2013; Charbonnier-Voirin et al., 2010; Jaiswal & Dhar, 2015; Sarros, Cooper, & Santora, 2008; B. Schneider et al., 2016; Wang, Rode, Shi, Luo, & Chen, 2013), and can play a mediating role on innovation (Berson, Nemanich, Waldman, Galvin, & Keller, 2006; B. Schneider et al., 2016). Thus, this research*: organisational innovation climate as a mediator of the relationship between complexity leadership and contextual ambidexterity* will help leaders to understand these relationships better.

1.2. RESEARCH PROBLEM

In an increasingly complex environment, new thinking is required, that addresses the contextual problems organisations are facing. This complex environment includes aspects of uncertainty and ambiguity, as well as interdependencies, captured in the term "complexity" (Clarke, 2013; Uhl-bien & Arena, 2017). Examples of these aspects are the global financial crisis, political instability (such as in America and South Africa) and increased connectivity that allows for large scale social, market and political disruption by the population (Uhl-bien & Arena, 2017). This research will explore two emerging concepts, complexity leadership and contextual ambidexterity, and the mediating effect of the contextual factor of an organisational innovation climate, to provide guidance in addressing these issues.

Literature has called for new models for developing and researching leadership (Uhl-bien & Arena, 2017), as older models, such as top-down bureaucratic leadership, are ineffective in today's knowledge-based economies (Day, Fleenor, Atwater, Sturm, & McKee, 2014; Uhl-Bien et al., 2007). Although the value of complexity leadership in these complex environments has been recognised (Clarke, 2013), further research in the complexity leadership field is needed to advance and develop the theory (Avolio, Walumbwa, & Weber, 2009; M. Schneider & Somers, 2006).

With the ever increasingly complex and dynamic business landscape, the ability to manage paradoxical business goals of improving current offerings and creating new ones (exploitation and exploration), has become essential for success (Uhl-bien & Arena, 2017; Wu & Wu, 2016). To simultaneously manage these innovation goals of exploiting and exploring, organisations need to embrace contextual ambidexterity (Gibson & Birkinshaw, 2004). However, with the old model of top-down leadership approach of bureaucracy seen in many organisations today, achieving this balance is challenging (Day et al., 2014; Uhl-bien & Arena, 2017; Uhl-Bien et al., 2007).

Guidance on how leaders can promote ambidexterity is lacking, even though they are vital to the process (Gibson & Birkinshaw, 2004; O'Reilly & Tushman, 2013; Raisch & Birkinshaw, 2008). Therefore, this research intends to address both the problem of further research into complexity leadership and its effects on contextual ambidexterity.

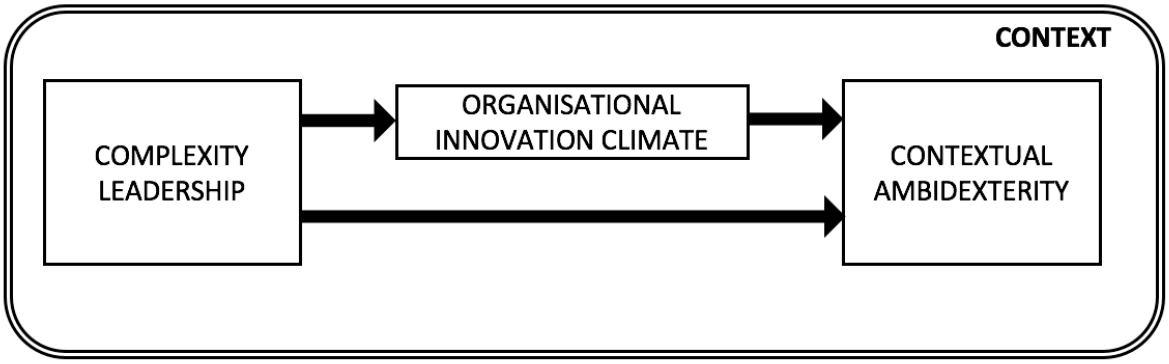
One must not forget the context that organisations and leaders find themselves in, and that which the leader can create to increase performance. Part of that context is the organisational innovation climate. There has been increased interest in organisational climate research in more recent years (B. Schneider et al., 2013), and this shows the importance of contextual factors that can be changed and harnessed for an environment capable of contextual ambidexterity (Keller & Weibler, 2014; Mendes, Gomes, Marques-Quinteiro, Lind, & Curral, 2016; Uhl-bien & Arena, 2017). Although many researchers have focused on specific leadership styles creating a climate that fosters individual ability to innovate, and that leadership is an antecedent of climate (Jaiswal & Dhar, 2015; B. Schneider et al., 2016), there is a call for further research specifically in the complexity leadership field (Mendes et al., 2016). Literature also calls for studies that investigate the contextual factors that mediate the leader's influence on contextual ambidexterity (Avolio et al., 2009; Berson et al., 2006). The mediating role of organisational innovation climate is supported by literature (B. Schneider et al., 2016), yet that role in complexity leadership is lacking (Avolio et al., 2009; Berson et al., 2006; M. Schneider & Somers, 2006).

The researcher could not find any previous research analysing the direct relationship of complexity leadership and contextual ambidexterity. The role of organisational innovation climate as a mediator, in the relationship of complexity leadership and contextual ambidexterity, has also not been investigated. The researcher will address the issues discussed, namely the relationship of complexity leadership with contextual ambidexterity and organisational innovation climate, and the role of an organisational innovation climate as a mediator. The research problem and title stem from the issues discussed above and leads to the research purpose.

1.3. RESEARCH PURPOSE

The purpose of this quantitative study is to investigate the mediating effect of an organisational innovation climate on the relationship between complexity leadership and contextual ambidexterity. These constructs exist in a complex context of an organisation. Figure 1 below shows the researcher’s conceptualised framework of these relationships.

Figure 1: Conceptualisation of research purpose



From Figure 1 the direct relationship between complexity leadership and contextual ambidexterity can be seen, as well as through the mediator of organisational innovation climate. Complexity leadership is the key independent variable. Organisational innovation climate also has a direct effect on contextual ambidexterity as per a classical mediation model. The research will focus on these constructs, as defined by the definitions in the literature review. The research purpose is aligned to the gaps identified in the research problem and literature review and leads to the research objectives and hypotheses. Using this framework quantitative statistical analysis of secondary data using structural equation modelling was performed.

From the research problem discussed above, this research also has the purpose to attempt to contribute to theory and business. It is hoped that theory will be enriched as Complexity Leadership Theory is an emerging concept, and further research in the field is called for. The researcher has developed a new conceptual model that combines these constructs and investigates the relationships between them.

The purpose of this research is to endeavour to assist organisations to apply insights learned to daily management and leadership. The challenge of managing simultaneous exploitation and exploration can hopefully be addressed, as well as the leader's effectiveness in doing so. Identifying leadership skills that enable contextual ambidexterity is likely to be advantageous and increase organisational performance. Leadership strategies to confront and overcome the increased complexity of the organisational context may also be beneficial. As leadership is contextualised (Hannah, Uhl-Bien, Avolio, & Cavarretta, 2009), the relevance of the approach to this research, that takes contextual factors into account, and the relationship between leadership and the context may also help leaders solve real-world problems.

1.4. DOCUMENT PURPOSE & STRUCTURE

This research aims to investigate the mediating effect of organisational innovation climate on the relationship between complexity leadership and contextual ambidexterity.

This chapter introduced the research problem and purpose. The remainder of the document is structured as follows:

- Chapter 2: A review of the available academic literature.
- Chapter 3: The research objective and hypothesised relationships.
- Chapter 4: The research methodology used, given the nature of the research problem and the secondary quantitative data available; as well as the applicable quantitiative data analyses, performed to support or disprove the hypothesised relationships;
- Chapter 5: The results obtained from the quantitative data analysis;
- Chapter 6: A discussion on the results obtained as it relates to the literature reviewed and the hypothesised relationships;
- Chapter 7: A conclusion of findings from the research, its implications for business, limitations, as well as recommendations for future research.

2. THEORY AND LITERATURE REVIEW

This section covers the theory and literature review of the research variables of contextual ambidexterity, complexity leadership and organisational innovation climate. These variables will be referred to as constructs for this research, as they are abstract concepts that are not easy to measure and not stated in a specific or applied way (Creswell, 2012).

The important constructs are systematically reviewed, as well as their relationships. This leads to a conceptual framework of the research problem, with the objectives and hypothesis.

These constructs are:

- Contextual Ambidexterity: considered as exploitative and explorative innovation together.
- Complexity Leadership: composed of a variety of leadership styles with different sub-constructs.
- Organisational Innovation Climate: as the mediator of the relationship between complexity leadership and contextual ambidexterity.

2.1. CONTEXTUAL AMBIDEXTERITY

Organisations are faced with the challenge to be efficient in the management of today's business demands, search for new opportunities and be adaptive enough to deal with the changing context of the landscape (Floyd & Lane, 2000; Gibson & Birkinshaw, 2004; Uhl-bien & Arena, 2017). Context as defined by Kutz (2008) “is the background in which an event takes place" (p.21). Dealing with this context, and striving to be an ambidextrous organisation poses a challenging task for today's managers.

The following section describes contextual ambidexterity as an emerging requirement for organisations and its theoretical background. Included is the constructs origins from innovation, both exploitative and explorative, and ambidexterity is explored.

2.1.1. Innovation

Innovation refers to new ideas that are implemented, that are a better and improved way of doing things (Van de Ven, 2016; West & Rickards, 1999). Organisations deal with the pressure to be innovative (West & Rickards, 1999), and therefore leaders must manage organisational innovation with intent.

A central theme in innovation literature is that of incremental and radical innovation (Raisch & Birkinshaw, 2008). Radical innovation is the switch to new concepts and products, whereas incremental innovation is minor adaptations.

2.1.2. Exploitation & Exploration Innovation

March (1991) introduced the concepts of exploitation and exploration innovation to the organisational literature. Different management approaches are needed and may be appropriate for exploitative innovation, but detrimental to exploratory innovation, and the

success indicators for each approach must be different (Danneels, 2002; Raisch & Birkinshaw, 2008).

The differences in the two methods are explained below:

- *Exploitation*: focuses on existing paradigms, that are refined to be more efficient (March, 1991; Raisch & Birkinshaw, 2008). Incremental innovations designed to meet existing customer needs that leads to stability, but at the risk of inertia (Lavie et al., 2010; Raisch & Birkinshaw, 2008). The communication is top-down from higher hierarchical levels, due to experiential learning (Raisch & Birkinshaw, 2008).
- *Exploration*: focuses on new alternatives, associated with experimentation, search and discovery (March, 1991; Raisch & Birkinshaw, 2008). Radical innovations to meet the needs of emergent customers; thus flexibility and adaptation are required (Lavie et al., 2010; Raisch & Birkinshaw, 2008). Communication is horizontal and bottom-up from low hierarchical levels, due to experimental learning (Raisch & Birkinshaw, 2008).

Levinthal and March (1993) conclude that success and sustainability depend on an organisation's ability to "engage in enough exploitation to ensure the organisation's current viability and to participate in enough exploration to ensure future viability" (p. 105). Therefore exploitation and exploration are linked and even intertwined, but determining this balance is complicated (Floyd & Lane, 2000; Levinthal & March, 1993). To find the balance organisations need to deal with the internal tensions and conflicting demands of their environments and context (Floyd & Lane, 2000; Raisch & Birkinshaw, 2008). This balance is called ambidexterity.

2.1.3. Ambidexterity

The term organisational ambidexterity was first used by Duncan in 1976(Raisch & Birkinshaw, 2008). Duncan suggested "dual structures", one focusing on alignment and the other on adaptation, to deal with conflicting management demands.

Ambidextrous organisations are those that successfully coordinate exploitative and explorative innovation, to respond to the changing business context (Benner & Tushman, 2015; Lavie et al., 2010). Focusing on just one of these approaches can result in long-term failure, and thus organisations need to do both simultaneously (Birkinshaw & Gupta, 2013; Levinthal & March, 1993). Organisations focusing solely on exploration will not gain returns on its internal and experiential knowledge, whereas focusing on exploitation will result in elimination (Levinthal & March, 1993). In other words, if organisations only focus on exploration they will not benefit from lessons learned from inside the organisation and make improvements to these processes. Whereas if exploitation is the focus, they will have no new product development and eventually become obsolete in the market.

Tushman and O'Reily (1996) define ambidexterity as "The ability to simultaneously pursue both incremental and discontinuous innovation…from hosting multiple contradictory

structures, processes, and cultures within the same firm" (p.24), and that it was a requirement for long-term firm survival. Since that paper, there has been a significant amount of interest and research into the construct, coming from various sources such as organisational learning, strategic management and organisational design (O'Reilly & Tushman, 2013; Raisch & Birkinshaw, 2008).

In the complex environments organisations face today, leaders need to support and guide processes that allow for stability by exploitation of the current context and change by explorations of the emerging context (Mendes et al., 2016). This concept has led to literature that explores organisational ambidexterity, and the balancing of exploitative and exploratory innovation (Benner & Tushman, 2015). Even with the change of business context and innovation in the last decade, the concepts of ambidexterity and teaching in the field of business remains sound but is still a developing paradigm (Benner & Tushman, 2015; Raisch & Birkinshaw, 2008).
Part of this development is the concept of contextual ambidexterity.

2.1.4. Contextual Ambidexterity

As mentioned above, Duncan (1976) suggested "dual structures" be established, as this organisational separation would solve the balancing dilemma between the two types of innovation, and reduce the trade-offs (Gibson & Birkinshaw, 2004; Lavie et al., 2010). This concept was labelled as "structural ambidexterity" by Gibson and Birkinshaw (2004). A structurally ambidextrous organisation would thus have differentiated units (Lavie et al., 2010), that pursue different strategies, have varied structures and cultures, and match the task environment with specific needs (Gibson & Birkinshaw, 2004; Tushman & O'Reilly, 1996).

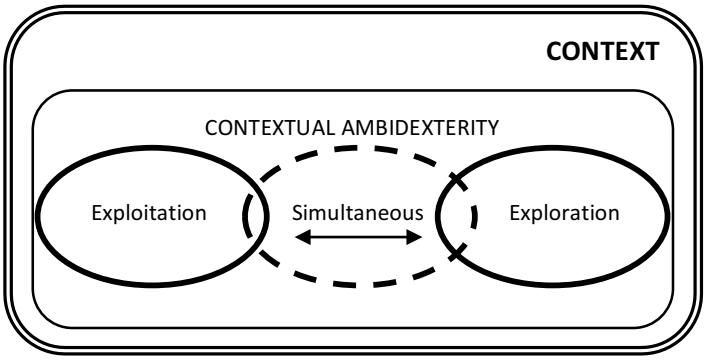
With the ever increasingly complex and dynamic business landscape, the ability to manage paradoxical business goals (exploitation and exploration) has become essential for success (Uhl-bien & Arena, 2017; Wu & Wu, 2016). This insight has led to scholar's interest in a paradoxical perspective of simultaneously managing these seemingly contradictory pressures, rather than using structurally different units (Gibson & Birkinshaw, 2004). To achieve the desired balance of these opposing demands, Gibson and Birkinshaw (2004) developed the concept of "contextual ambidexterity".

Gibson and Birkinshaw (2004) defined contextual ambidexterity as "the behavioural capacity to simultaneously demonstrate alignment and adaptability across an entire business unit" (p.209). This concept differs markedly from the previous concept of structural ambidexterity. Contextual ambidexterity is not achieved through dual structures, but by creating processes or systems, and therefore creates an organisational context that "encourages individuals to make their own choices as to how they divide their time between alignment and adaptability oriented activities" (Gibson & Birkinshaw, 2004, p. 221). This organisational context is the

organisational innovation climate construct of this research and is explored in Section 2.3 below.

To conceptualise the concept of contextual ambidexterity, the researcher used the literature, and a previously conceptualised model by Lavie, Stettner and Tushman (2010) (see Figure 19 in Appendix A), to further understand this paradoxical approach to ambidexterity. Figure 2 below shows the researcher's contextual ambidexterity conceptualised model. This model shows the how contextual ambidexterity can be achieved by simultaneous exploitation and exploration, through the systems and processes created, and the organisational context that encourages these activities.

Figure 2: Conceptualised model of contextual ambidexterity



This section covered the construct of contextual ambidexterity. As leaders play a key role in developing and promoting organisational ambidexterity (Gibson & Birkinshaw, 2004; Raisch & Birkinshaw, 2008), the next section moves onto leadership, and Complexity Leadership Theory. The relationships between the two constructs is explored in Section 2.4.1 later.

2.2. LEADERSHIP & COMPLEXITY LEADERSHIP

With contextual ambidexterity covered in the previous section, in this section, a brief overview of the evolution of leadership theory and its current trends is explored. This will be followed by a discussion on complexity theory and the roots of Complexity Leadership Theory (CLT) explained. Thereafter, CLT will be reviewed in the context of contextual ambidexterity.

2.2.1. Leadership

Leadership theory has a long history spanning more than a century (Day et al., 2014). Until recently, research literature has focused on solo heroic leadership models (Clarke, 2013). These models have stemmed from a top-down bureaucratic paradigms, that were effective for industrial based economies, but are not well suited for the current knowledge-based economies we are facing (Uhl-bien & Arena, 2017; Uhl-Bien et al., 2007). Additionally, these leadership approaches are thought to be ineffective for the complex challenges leaders face (Day et al., 2014).

The leadership field is evolving into a more holistic view of leadership, that looks at the context and processes that constitute leadership (Antonakis, Avolio, & Sivasubramaniam, 2003; Avolio et al., 2009). The context, and how leadership effectiveness is dependent on it, has moved the leadership literature to a new era, and to a level that sees the current literature as not invalid, but incomplete (Osborn, Hunt, & Jauch, 2002; Osborn & Marion, 2009). This highlights the importance of the concept of context in leadership literature, and hence this research topic. Therefore the leaders needed for this era will need to have a firm grasp on the context and display what is referred to as contextual intelligence (Kutz, 2008; Kutz & Bamford-Wade, 2013).

As such, leadership literature has grown exponentially in the last decade and has produced some new leadership theories (Avolio et al., 2009; Day et al., 2014; Dinh et al., 2014; Gardner, Lowe, Moss, Mahoney, & Cogliser, 2010). These theories are however moving towards a more systemic perspective, that incorporates the social context that the leader operates in (Clarke, 2013; Dinh et al., 2014; Havermans et al., 2015; Kutz & Bamford-Wade, 2013; Osborn et al., 2002). Emerging systems research in the leadership literature outnumber other emerging leadership approaches and has resulted in a systems thematic theory of leadership (Dinh et al., 2014).

Complexity Leadership Theory (CLT) falls under this systemic theme, which captures aspects of contextual features. CLT has its origins in a field of complexity and systems theory, namely Complex Adaptive Systems (CAS) (Marion & Uhl-Bien, 2001; M. Schneider & Somers, 2006; Uhl-Bien et al., 2007). The next section will briefly explain the evolution of systems theory, its link to complexity science and CAS, and therefore the roots of CLT.

2.2.2. General Systems Theory, Complexity Theory & Complex Adaptive Systems

A system can be defined as a set of interrelated elements (Ackoff, 1971). Von Bertalanffy (1972) formulated General Systems Theory (GST) based on Aristotle's statement of "the whole is more than the sum of its parts" (p. 407). Von Bertalanffy (1972) defined GST as "a logico-mathematical field whose task is the formulation and derivation of these general principles that apply to "systems" in general" (p.411). Katz and Khan (1978) applied GST to organisational theory and described its emphasis on social aspects and structure, and how systems tend towards equilibrium. GST, therefore, implies stable patterns of relationships within boundaries (M. Schneider & Somers, 2006).

GST has had a large influence on leadership research, leading to the systems thematic theory mentioned above as an appropriate framework (Dinh et al., 2014; M. Schneider & Somers, 2006). Complexity theory (CT) evolved from GST, as complexity theorists found GST to be limited in certain types of systems (Day et al., 2014; Pascale, 1999; M. Schneider & Somers, 2006; Uhl-Bien et al., 2007). The basic unit of analysis in CT is CAS (complex adaptive

systems). In the CT language "CAS reflect an ability to adapt through the emergent characteristic of self-organization, which comes from the inter-dependency of their individuals or agents" (M. Schneider & Somers, 2006, p.355).

CAS first appeared in management literature from Pascal (1999). Cilliers (2000) further applied this in the business context, stating that "Complexity theory has implications for the way we conceive of the structure of an organization, as well as for the way in which complex organizations should be managed" (p.23). The CAS is defined by Uhl-Bien et al. (2007) as "changeable structures with multiple, overlapping hierarchies, and like the individuals that comprise them, CAS are linked with one another in a dynamic, interactive network" (p.299). As the concept grew, the wealth of popular management literature saw organisations as complex systems (Richardson & Cilliers, 2001), and a shift in thinking and theories of leadership was called for (Richardson & Cilliers, 2001; Uhl-Bien et al., 2007).

This development of CT and CAS brought about new conceptualisations of organisational structure and leadership, and ultimately Complexity Leadership Theory (CLT) (Dinh et al., 2014; Gardner et al., 2010; Lichtenstein et al., 2006; Marion & Uhl-Bien, 2001; M. Schneider & Somers, 2006).

2.2.3. Complexity Leadership Theory (CLT)

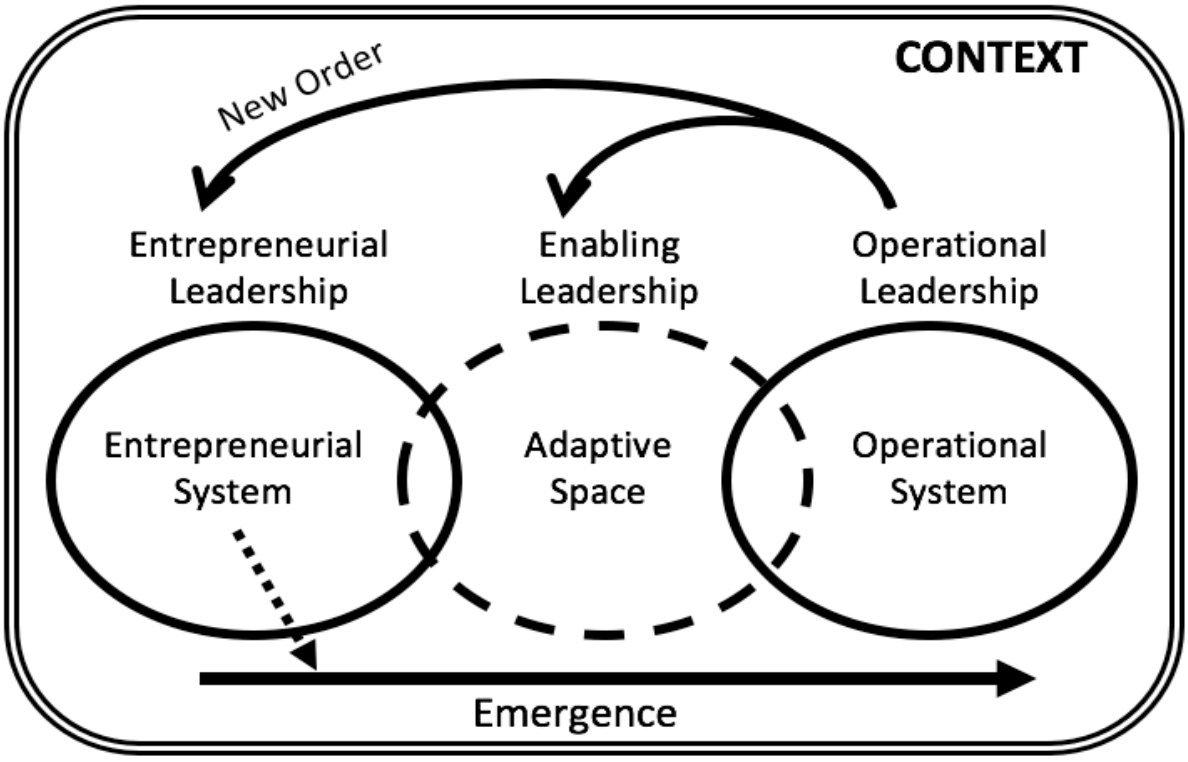
As the origins of CLT from a theory base are explained above, the details of CLT, its development as a business imperative and its terms and relationships to the research framework will be explored. As CLT is more towards leadership as a construct than an individual leader, and leadership that perceives complexity (Uhl-bien & Arena, 2017; Uhl-Bien et al., 2007), for this study, the researcher will refer to leadership that displays CLT skills as complexity leadership.

Uhl-Bien, Marion and McKelvey (2007) presented a developed framework for CLT in 2007 as "three entangled leadership roles (i.e., adaptive leadership, administrative leadership, and enabling leadership) that reflect a dynamic relationship between the bureaucratic, administrative functions of the organization and the emergent, informal dynamics of complex adaptive systems (CAS)" (p.298). The call for a new model of leadership was expressed, due to the changing complexity and context of the business landscape driven by globalisation and technology (Uhl-Bien et al., 2007). Since the 2007 article, complexity has only increased, with an ever more connected society, allowing political, social and market disruption (Uhl-bien & Arena, 2017). These factors make a further case for a leadership model that can help organisations manage this complexity. This can lead to leaders that are successful in turbulent environments (Dinh et al., 2014).

This complexity approach to leadership states that “complexity is about rich interconnectivity” (Uhl-bien & Arena, 2017, p. 9). This approach sees leadership not as individual or leader-centric (Clarke, 2013; Hazy & Uhl-Bien, 2015), but rather as “as a shared emergent process where individuals and teams interact and learn from each other to produce novelty and adaptive capacity” (Mendes et al., 2016, p. 302). Complexity leadership draws attention to three types of leadership that are needed to create adaptability to deal with the complex context of the business landscape: operational (administrative) leadership, entrepreneurial (adaptive) leadership and enabling leadership.

Figure 3 below shows the complexity leadership model (Uhl-bien & Arena, 2017), which illustrates the relationship of these three leadership types. This model has been adapted to include the researcher’s conceptualisation of the context that the leader operates in and creates, as well as the emergence enabled by the entrepreneurial leader and system.

Figure 3: Complexity leadership model



Adapted from Uhl-bien & Arena, 2017

The model above shows the three types of systems and leadership described in CLT, and the process of emergence. These are further explained below.

Operational leadership: is described as dealing with the alignment of systems and processes, to execute ideas and produce outcomes (Uhl-bien & Arena, 2017). This is likened to exploitative innovation. A key role is to convert emergent ideas into structures that produce innovation and ongoing results (Uhl-bien & Arena, 2017).

Entrepreneurial leadership: is the source of novelty, that is the creation of new ideas, products, services and innovative solutions, motivated by complexity pressures (Uhl-bien & Arena, 2017). This is likened to explorative innovation.

Enabling leadership: is the enabling of conditions for the operational system and entrepreneurial system to interact in an adaptive space, and thus for the organisation to be agile in the face of complexity, therefore operating as a CAS (Uhl-bien & Arena, 2017). Enabling leadership is a unique form of leadership introduced from complexity thinking (Uhl-bien & Arena, 2017).

Adaptive space: Uhl-bien and Arena (2017) describe the adaptive space as “contexts and conditions that enable networked interactions to foster the generation and linking up of novel ideas, innovation and learning in a system” (p.12). Complexity leadership accepts that not everything can be planned and controlled, and allow for self-organising emergence, by capitalising on the tension between the entrepreneurial system and the operational system to generate innovation in this adaptive space (Uhl-bien & Arena, 2017).

Emergence: refers to the adaptive response of the organisation facing complexity and is the resistance of the pull to "order" or equilibrium of the top-down hierarchical approach of management (Uhl-bien & Arena, 2017). In other words, resisting change, and relying on the previous methods of "that is the way we have always done it around here". Uhl-bien & Arena (2017) describe emergence as "the creation of new order that happens when agents (e.g., people, technology, information, resources) in a networked system combine together in an environment poised for change to generate the emergence of something that did not exist previously” (p.10). Figure 3 above shows the initiation of the new order from the operational leader, and emergence enabled by the entrepreneurial leader through the organisation.

Therefore complexity leadership is agile and can transition between these three forms of leadership, to enable an adaptive space, thus allowing a complex system to become a CAS and tackle complexity with complexity (Uhl-bien & Arena, 2017; Uhl-Bien & Marion, 2009; Uhl-Bien et al., 2007). For that reason, CLT is a contextualised leadership theory based on a systems view and complexity science.

As mentioned above, of great importance, is the context in which the leader operates and creates. As Osborn et al. (2002) state “leadership and its effectiveness, in large part, are dependent upon the context. Change the context and leadership changes” (p. 797). Complexity leadership uses enabling leadership to create the organisational context that enables complexity. These enabling factors, within the organisational context, are what creates effective CAS dynamics (Uhl-bien & Arena, 2017; Uhl-Bien et al., 2007). The organisational context is the systems, processes, beliefs and perceptions that shape behaviours in the organisation (Charbonnier-Voirin et al., 2010; Gibson & Birkinshaw, 2004;

Sarros et al., 2008). This organisational context can, therefore, be viewed as the organisational structure, culture and climate (Gibson & Birkinshaw, 2004). Climate and culture differ, and the reason the researcher is focusing on climate will be explored in Section 2.3 below. For this research, the researcher will focus specifically on the enabling factor of the organisational innovation climate that complexity leadership creates, within this organisational context. The mediating role of the organisational innovation climate will also be explored. The literature review of the organisational innovation climate and the constructs relationships will follow in the next sections.

Three essential sub-constructs that are linked to complexity leadership are: patterning of attention, developing networks, and contextual intelligence. These sub-constructs are part of the research measurement instrument for complexity leadership, and the survey questions are further explained in Section 4.5.5. These sub-constructs will be explored regarding the literature below.

Sub-constructs: patterning of attention, developing networks, and contextual intelligence

- ***Patterning of attention****:* as a construct, patterning of attention is associated with contextual leadership, and is therefore related to CLT, as CLT is a contextualised leadership theory (Osborn & Marion, 2009; Uhl-Bien et al., 2007). This concept is the ability and readiness of leaders individually and collectively to specify what information is important in achieving the firm's goals (Osborn et al., 2002). The leader creates a pattern of dialogue and discussion on what is important, and not what to do or how to do it, and thus helps individuals share and transform knowledge by exchanging this knowledge (Osborn et al., 2002; Osborn & Marion, 2009) Patterning of attention results in higher innovation performance and involves leaders working with subordinates to discover what information is needed to improve the system (Osborn & Marion, 2009).
- ***Developing networks:*** This construct relates to CLT, as network development is essential in creating the adaptive space, and allowing emergence (Arena & Uhl-Bien, 2016; Uhl-bien & Arena, 2017; Uhl-Bien et al., 2007). Complexity leadership is embedded in CAS, and are agents interacting in neural-like networks, and thus enable adaptive and enabling leadership through the contexts and patterns of behaviour they create (Uhl-Bien & Marion, 2009; Uhl-Bien et al., 2007). Networks need to be created to connect subordinates to a broad variety of information sources and bridge internal organisational boundaries and functions (Osborn & Marion, 2009; Uhl-Bien et al., 2007). Additionally with the change in the business context, from information technology and globalisation, leading to increased complexity, organisations no longer operate independently (Osborn et al., 2002; Uhl-bien & Arena, 2017). Therefore, they are part of unique networks, both

internally and externally, and these networks need to be maintained and efficiently developed.

These two sub-constructs work together: “The information and the connections developed by the leader should channel emergent behavior without limiting innovation and creativity” (Osborn & Marion, 2009, p. 195).

- ***Contextual intelligence:*** Kutz (2008) defines contextual intelligence as “the ability to quickly and intuitively recognize and diagnose the dynamic contextual variables inherent in an event or circumstance and results in intentional adjustment of behavior in order to exert appropriate influence in that context” (p.23). CLT and contextual ambidexterity are inseparable from the context of the organisation, and therefore contextual intelligence is imperative. Kutz and Bamford-Wade (2013) describe a Contextually Intelligent leader as one who “appropriately interprets and reacts to changing and volatile surroundings” (p.20). This leadership characteristic will thus enable CAS. A leader with high contextual intelligence will be able to recognise and interpret the current context and enable adaptive capacity in the organisation (Kutz & Bamford-Wade, 2013). To constantly be contextually aware is a large ask of a single person, and is part of the reason the complexity leadership has a shared leadership view, and not that of individual centric (Hazy & Uhl-Bien, 2015). Contextual intelligence will enable the adaptive space needed from complexity leadership, and therefore emergence.

The researcher realises that there are many leadership theories. Therefore, it must be noted that although complexity leadership provides a powerful leadership lens, that “complexity leadership is not a panacea for our leadership problems” (Brown, 2011, p. 20). Even the combination of operational, entrepreneurial and enabling leadership. that makeup CLT leaves out key epistemologies that provide valuable data on any leadership situation (Brown, 2011). The theory of complexity also has limitations, as Cilliers (2000) states that a theory of complexity cannot help us to take specific positions, or to make accurate predictions. Therefore, looking at the aspects of complexity, it can only provide a general set of guidelines (Cilliers, 2000). A critique of the theory chosen by the researcher shows that other aspects have been considered, and may be a research limitation.

This section reviewed leadership, CLT and its roots, and the theoretical and business basis for its development. The relevance of CLT in the current complex context of the business landscape was also explored. Key sub-constructs, used in the measurement instrument, were also reviewed. The construct of organisational innovation climate was also introduced which is explored in the next section.

2.3. ORGANISATIONAL INNOVATION CLIMATE

The previous section covered leadership and CLT. This section will cover the mediating variable of organisational innovation climate, and provide the definitions as described by significant literature that will be used for this research. Its importance and relevance will also be explored.

As mentioned above, the organisational context in which the relationships of the constructs take place includes the organisational culture and climate. The researcher will be focusing on the climate. Climate differs from culture.

Culture is the deep structure of organisations and can be attributed to the early decisions that founders make about the organisation's structures and principles (B. Schneider et al., 2013, 2016). Pettigrew (1979) introduced the culture topic into organisational studies (B. Schneider et al., 2013). A widely accepted framework was developed by Schein (1983, 2010), that culture manifests itself at different levels of organisations (B. Schneider et al., 2013). Schein coined the phrase “organisational culture”. Schein (2004) defines culture as: “a pattern of shared basic assumptions that was learned by a group as it solved its problems of external adaptation and internal integration, that has worked well enough to be considered valid and, therefore, to be taught to new members as the correct way to perceive, think, and feel in relation to those problems" (p.17). Key to this definition is the concepts of *i) structural stability* (the foundation of group identity that holds the group together, and is why culture is so difficult to change), *ii) depth* (culture runs very deep, at an unconscious level, it is the way you do things and does not need an explanation), *iii) breadth* (affects everything in the organisation) and *iv) patterning of integration* (makes the group’s behaviours, values and rituals coherent) (Schein, 2004; B. Schneider et al., 2013, 2016).

Therefore, organisational culture is the deep underlying assumptions, that withstand change, and is more permeating than climate. There has been a shift to an increased interest in climate over culture research in more recent years (B. Schneider et al., 2013), and this shows the importance of contextual factors that can be changed and harnessed for an environment capable of contextual ambidexterity (Keller & Weibler, 2014; Mendes et al., 2016; Uhl-bien & Arena, 2017). The definition of climate, and how the researcher will define it for this study follows below.

Organisational climate research began around 1970 in the Industrial Psychology field due to the interest in the contrast of climate as an alternative to the focus on individual differences (B. Schneider et al., 2016). Although there have been some differences in the definitions of organisational climate, research has implied or stated that it is a perception of organisational procedures, policies and practices. (B. Schneider et al., 2016). Also, the observed behaviour

of the organisation's expectations, rewards and support concerning the procedures, policies and practices, and thus the context, that the individual experiences, completes the definition (Arena & Uhl-Bien, 2016; Charbonnier-Voirin et al., 2010; B. Schneider et al., 2013).
Organisational climate can therefore be defined as the shared contextual perceptions individuals experience regarding the policies, practices and procedures, that emerge through social interactions, and the behaviours they observe of expectations, rewards and support by the organisation (Charbonnier-Voirin et al., 2010; B. Schneider et al., 2013, 2016; Scott & Bruce, 1994). As the researcher has shown, culture can be more difficult to change. But with the correct policies, practices and procedures innovation can be encouraged and enabled, thus an innovation climate rather than an innovation culture is the focus of this research.

Extending the construct of organisational climate concerning contextual ambidexterity and CLT leads to the construct as described in the research problem of an organisational innovation climate. The enabling conditions of an organisational innovation climate, as it relates to CLT, is described by Arena and Uhl-Bien (2016) as adaptive space. Arena and Uhl-Bien (2016) state that this adaptive space "occurs in the interface between the operational and the entrepreneurial system" (p.24). This construct of the adaptive space of an organisational innovation climate is likened to what the literature describes as: an organisation's innovation climate (Jaiswal & Dhar, 2015), climate for organisational innovation (Sarros et al., 2008), organisation context (Gibson & Birkinshaw, 2004), climate of support for innovation (Cerne et al., 2013).

This nature of an organisational climate would logically lead to increased innovation in an organisation, and possibly play a vital role in the innovative behaviour of employees (Jaiswal & Dhar, 2015). Literature supports this and finds this organisational innovation climate as an antecedent for innovation and ambidexterity (Cerne et al., 2013; Charbonnier-Voirin et al., 2010; Jaiswal & Dhar, 2015; Sarros et al., 2008; B. Schneider et al., 2016; Wang et al., 2013)

The construct of organisational innovation climate has received a considerable amount of attention, especially from behavioural researchers (Sarros et al., 2008), and has, therefore, had evolving definitions. For this research, and as guided by the literature and items in the data collecting questionnaire, organisational innovation climate is defined as: a set of shared employee perceptions about the organisations context and workgroup environment to provide sufficient resources that encourages, supports, rewards and enables risk-taking, creativity, learning and initiative (Charbonnier-Voirin et al., 2010; Jaiswal & Dhar, 2015; Sarros et al., 2008; Wang et al., 2013).

The researcher realises that within the organisational context, this research only addresses the construct of organisational innovation climate and not that of culture, as discussed above.

Research that simultaneously studies organisational climate and culture may more fully capture the reality of organisational life and yield greater improvement in performance (B. Schneider et al., 2013). A critique of the theory chosen by the researcher shows that other aspects have been considered, and may be a research limitation.

This section covered the construct of organisational innovation climate, and the motivation of why this research is focusing on climate and not culture. The next section explores the importance of the relationship between the three research constructs: contextual ambidexterity, complexity leadership and organisational innovation climate. The proposed mediating role of the organisational innovation climate.

2.4. RELATIONSHIPS BETWEEN COMPLEXITY LEADERSHIP, CONTEXTUAL AMBIDEXTERITY & ORGANISATIONAL INNOVATION CLIMATE

Raisch and Birkinshaw (2008) investigated and reviewed the promoters and antecedents of ambidexterity, as well as the relationship of moderators. These studies have been in various leadership theories, but relationships between CLT and its mediators and outcomes is still emerging and called for (Avolio et al., 2009).

2.4.1. Complexity Leadership & Contextual Ambidexterity

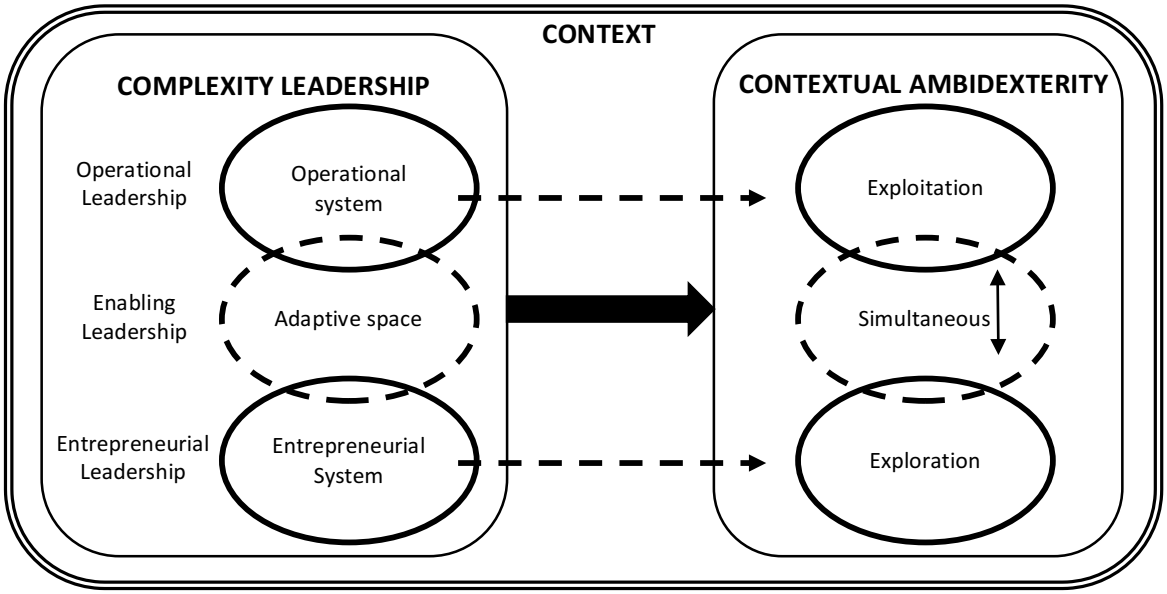
Leaders play a key role in developing and promoting organisational ambidexterity (Gibson & Birkinshaw, 2004; Raisch & Birkinshaw, 2008). Yet, there has been limited research on how leaders can promote ambidexterity (O'Reilly & Tushman, 2013). There have been studies indicating that transformational leadership behaviours promote ambidexterity (Baškarada, Watson, & Cromarty, 2016). Jansen et al. (2009) and Baškarada et al. (2016) showed that transformational leadership might be more appropriate for exploratory innovation, and transactional for exploitative innovation. As the leadership and ambidexterity literature is vast and covers a large time frame, the specific relationship between CLT and contextual ambidexterity will be the focus of this research.

The literature on complexity leadership and innovation is lacking, and further research has been encouraged (Avolio et al., 2009; Mendes et al., 2016). Organisations can no longer be designed or adopt simply rationalised structures, as these underestimate the complexity of context in which the organisation must function and adapt, or in other words, exploit and explore (Avolio et al., 2009; Uhl-Bien et al., 2007). Due to the dynamics of complexity theory, leaders can adapt to the complexity of the environment, and thus have a major role in promoting and enabling contextual ambidexterity (Havermans et al., 2015).

CLT and contextual ambidexterity have the same goals. The operational leader and system look to align systems and processes, therefore, exploitation. The entrepreneurial leader and system look to create new ideas and innovative solutions, therefore, exploration. Moreover,

the adaptive space is the interface between these systems allowing the organisation to be agile, therefore allowing for simultaneous exploitation and exploration and thus contextual ambidexterity. Therefore, the researcher conceptualises the following model showing these relationships, in Figure 4 below.

Figure 4: Conceptualised model of relationship between complexity leadership and contextual ambidexterity



An objective of this research is to determine the extent of this relationship. It possibly has important implications for organisations and their leaders and if shown to be strongly positive, can be a leadership style to adopt and teach others, to enable contextual ambidexterity.

2.4.2. Complexity Leadership & Organisational Innovation Climate

Cerne et al. (2013) showed that it is important for leaders to encourage individuals creativity, and establish a climate that values innovation and experimentation. As shown above, complexity leadership needs to create an adaptive space, likened to an organisational innovation climate, to enable emergence and innovation, as leadership is a complex interaction between the social and organisational context (Arena & Uhl-Bien, 2016; Day et al., 2014; Uhl-bien & Arena, 2017). Although many researchers have focused on specific leadership styles creating a climate that fosters individual creativity, and that leadership is an antecedent of climate (Jaiswal & Dhar, 2015; B. Schneider et al., 2016), there is a call for further research specifically in the complexity leadership field (Avolio et al., 2009; Mendes et al., 2016).

One of the objectives of this research is to investigate the relationship of the theoretical teachings of CLT, and determine if complexity leadership creates an organisational innovation climate.

2.4.3. Organisational Innovation Climate & Contextual Ambidexterity

The context theme running through this research includes that of the organisational innovation climate created in organisations. When a supportive context, such as an organisational innovation climate, is created, individuals can engage in contextual ambidexterity (Gibson & Birkinshaw, 2004). As the definition of an organisational innovation climate previously discussed is the context that: encourages, supports, rewards and enables risk-taking, creativity, learning and initiative, the relationship can be seen. This nature of an organisational climate would logically lead to increased innovation in an organisation, and enable innovative behaviour of individuals (Jaiswal & Dhar, 2015). Literature supports this and finds this organisational innovation climate as an antecedent for contextual ambidexterity (Cerne et al., 2013; Charbonnier-Voirin et al., 2010; Jaiswal & Dhar, 2015; Sarros et al., 2008; B. Schneider et al., 2016; Wang et al., 2013).

Further support for these findings is an objective of this research. This objective is important, firstly to show correlation with previous studies, and secondly, attempt to support the emerging concept of contextual ambidexterity.

2.4.4.Complexity Leadership, Organisational Innovation Climate & Contextual Ambidexterity

The literature that explains the role of leadership to create the context of an organisational innovation climate, and that an organisational innovation climate results in ambidexterity, also shows the relationship of how leaders are vital to this process (Cerne et al., 2013; Damanpour & Schneider, 2006; Gibson & Birkinshaw, 2004; Uhl-bien & Arena, 2017). Organisational leaders are responsible for creating and maintaining the organisational innovation climate to enable contextual ambidexterity (Damanpour & Schneider, 2006). It is the goal of complexity leadership to recognise what climate will generate creative ideas and drive adaptability, learning and the innovative process (Uhl-Bien et al., 2007).

The theories of the literature are sound, yet further research of the interactions of the constructs will be valuable to understand contextual ambidexterity in complex environments (Mendes et al., 2016). This is an objective of this research and will attempt to add to theory and organisational insights.

2.4.5. Organisational Innovation Climate as a Mediator

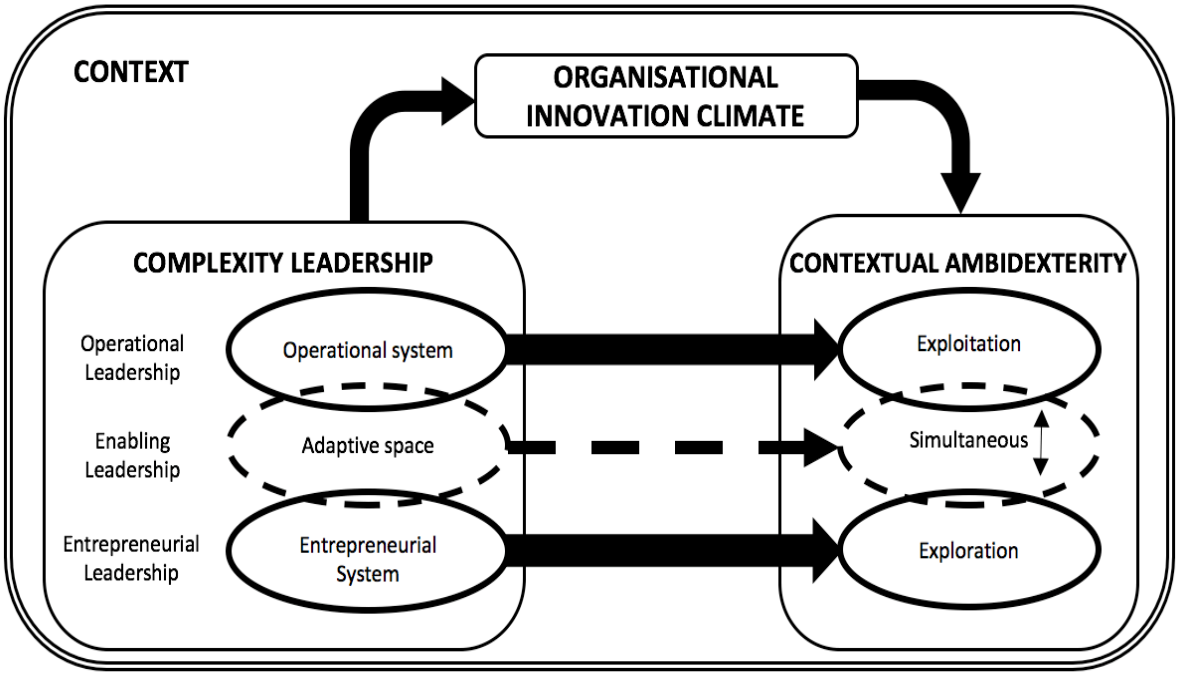
The moderating role of climate for innovation has been established, and that it enhances the role of transformational leadership and organisational innovation (Charbonnier-Voirin et al., 2010), and that this relationship is positive (Damanpour & Schneider, 2006).
When looking at mediation Berson et al. (2006) showed mediating effects of the organisational context for both exploitation and exploration. Several other studies have also supported the mediating role of climate on innovation (B. Schneider et al., 2016). Literature has expressed that further mediation studies looking at various leadership styles, especially complexity-based

models, is needed (Avolio et al., 2009; Berson et al., 2006; M. Schneider & Somers, 2006). The researcher aims to address this, and will thus attempt to add to the leadership literature, and aims to provide insights for leaders on the importance of the organisational innovation climate. The definition of a mediating variable and the appropriate analysis will be explored in the methodology section below.

2.4.6. Conceptualised model of the relationships

From the literature reviewed above the researcher conceptualises the model in Figure 5 below: complexity leadership has a relationship with contextual ambidexterity, which is mediated by the organisational innovation climate, which all interact within the organisational context. Complexity leadership also has a relationship with organisational innovation climate.

Figure 5: Conceptualised model of the relationship between complexity leadership and contextual ambidexterity, mediated by organisational innovation climate.



2.5. CHAPTER CONCLUSION

From the literature reviewed, and insights gained, the importance of contextual ambidexterity for organisations success in today's complex business landscape is evident. To enable this, the link between the concepts of complexity leadership and CLT appears theoretically suitable. Given that the context plays a vital role, and that complexity leadership is inherently contextualised, the organisational innovation climate that complexity leadership creates should enable and mediate emergence and contextual ambidexterity.

The relationships of the emerging concepts of complexity leadership and contextual ambidexterity, with organisational innovation climate as a mediator, has not been established in the literature. The researcher, therefore, conceptualised the model in Figure 5 highlighting that complexity leadership has a relationship with contextual ambidexterity, which is mediated

by the organisational innovation climate. These all interact within the organisational context. This model leads to the conceptual and theoretical framework of the researcher, stating the objectives, and hypothesis formulation.

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3. CONCEPTUAL FRAMEWORKS & HYPOTHESIS

This section covers the conceptual frameworks and hypothesis of the researcher, as guided by the conceptualised model (Figure 5) from the literature review done in the previous section. The researcher has four objectives for this research, detailed below.

3.1. CONCEPTUAL AND THEORETICAL FRAMEWORK

The diagrammatic process of frameworks helps clarify the defined measurable variables (constructs) and the hypothesised relationships that can be tested, and thus clarifies the research design (Burns & Burns, 2008). The conceptual framework is used to develop the theoretical framework.

Figure 6 below shows the conceptual framework and Figure 7 the theoretical framework. These depict the applicable constructs and the relationships (arrows) that the researcher will investigate. Straight arrows indicate direct relationships and curved arrows the mediating relationship. The letter "H" refers to the appropriate hypothesis as stated in Section 3.2 below.

Complexity leadership is the independent variable, with a relationship with the dependent variables contextual ambidexterity and organisational innovation climate. Organisational innovation climate is the independent mediating variable between complexity leadership and contextual ambidexterity, as well as the independent variable in the direct relationship with contextual ambidexterity. Contextual ambidexterity, looking at exploitation and exploration, are the dependent variables in all relationships.

Figure 6: Conceptual framework

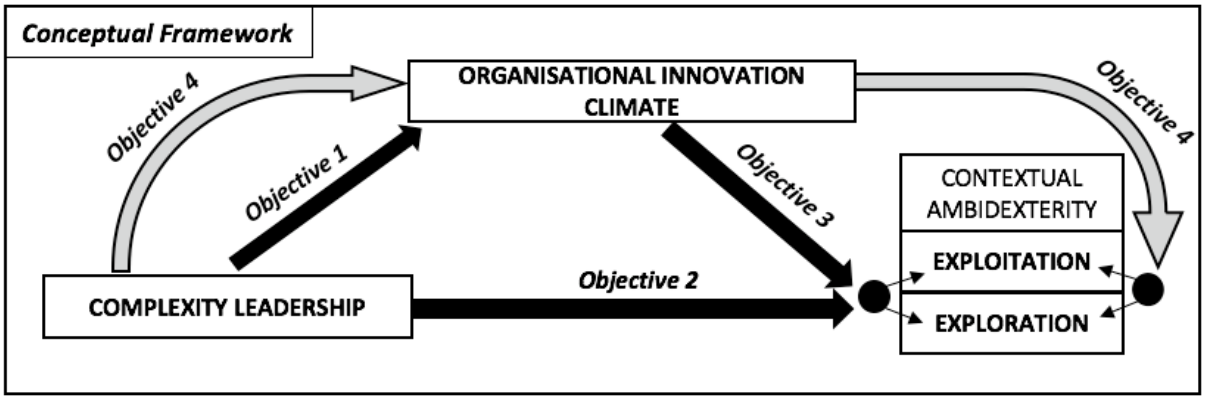
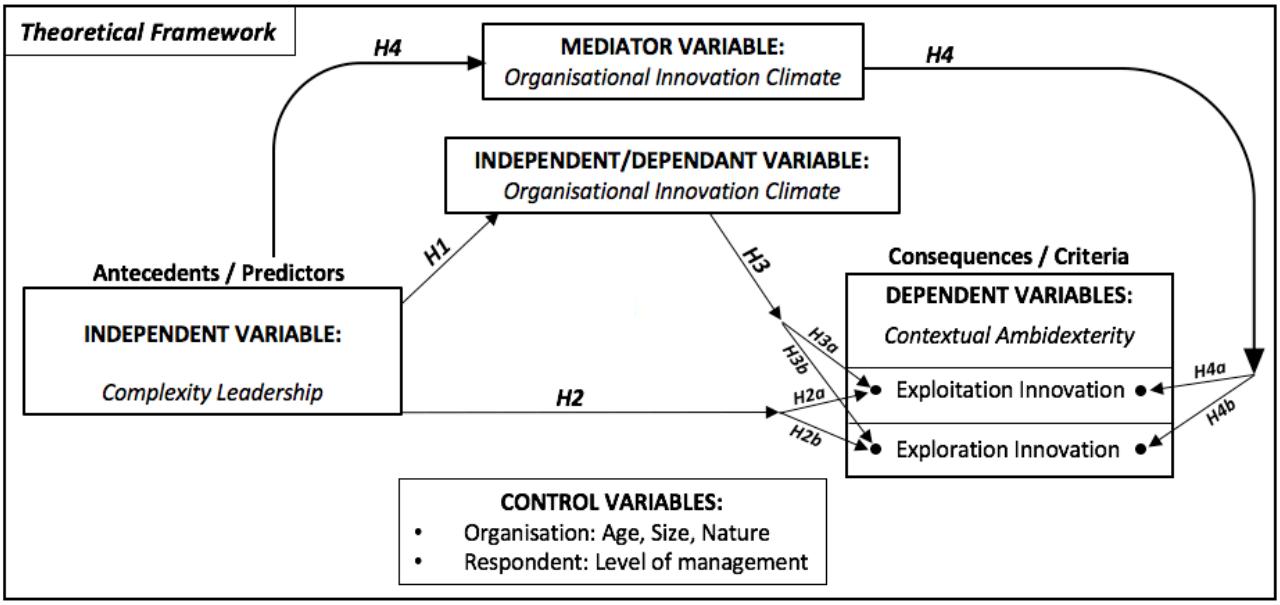


Figure 7: Theoretical framework



3.2. HYPOTHESES

In quantitative research, hypothesis statements are necessary and describe the relationships among attributes to be investigated (Creswell, 2012).

The objectives and hypotheses shown in Figure 6 above are stated below.

Objective 1: Confirm that there is a positive relationship between complexity leadership and organisational innovation climate. Therefore, complexity leadership leads to an organisational innovation climate.

- **Hypothesis 1 (H1)**

$H_0$1*:* No significant positive linear relationship exists between complexity leadership and organisational innovation climate.

$H_1$1: A significant positive linear relationship exists between complexity leadership and organisational innovation climate.

Objective 2: Confirm that there is a positive relationship between complexity leadership and contextual ambidexterity (exploitation and exploration). Therefore, complexity leadership leads to exploitation and exploration.

- **Hypothesis 2a (H2a)**

$H_0$2a*:* No significant positive linear relationship exists between complexity leadership and exploitation innovation.

$H_1$2a: A significant positive linear relationship exists between complexity leadership and exploitation innovation.

- **Hypothesis 2b (H2b)**

$H_0$2b*:* No significant positive linear relationship exists between complexity leadership and exploration innovation.

$H_1$2b: A significant positive linear relationship exists between complexity leadership and exploration innovation.

Objective 3: Confirm that there is a positive relationship between organisational innovation climate and contextual ambidexterity (exploitation and exploration). Therefore, organisational innovation climate leads to exploitation and exploration.

- **Hypothesis 3a (H3a)**

$H_0$3a*:* No significant positive linear relationship exists between organisational innovation climate and exploitation innovation.

$H_1$3a: A significant positive linear relationship exists between organisational innovation climate and exploitation innovation.

- **Hypothesis 3b (H3b)**

$H_0$3b*:* No significant positive linear relationship exists between organisational innovation climate and exploration innovation.

$H_1$3b: A significant positive linear relationship exists between organisational innovation climate and exploration innovation.

Objective 4: Determine if organisational innovation climate has a mediating effect on the relationship between complexity leadership and contextual ambidexterity (exploitation and exploration).

- **Hypothesis 4a (H4a)**

$H_0$4a: organisational innovation climate has no significant mediating effect on the relationship between complexity leadership and exploitation

$H_1$4a organisational innovation climate has a significant mediating effect on the relationship between complexity leadership and exploitation.

- **Hypothesis 4b (H4b)**

$H_0$4b*: organisational innovation climate* has no significant mediating effect on the relationship between complexity leadership and exploration

$H_1$4b: organisational innovation climate has a significant mediating effect on the relationship between complexity leadership and exploration.

All objectives will involve structural equation modelling and will be tested at a 95% confidence interval. The reason and motivation for structural equation modelling as the chosen analysis technique is explained in the methodology Section 4.6.2 below. The next section will explain the proposed methodology and design for this research.

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4. METHODOLOGY & DESIGN

The methodology and design of a study is impacted by the hypotheses, and thus selecting the correct methodology and design is crucial to the success of a study (Saunders & Lewis, 2012; Zikmund, Babin, Carr, & Griffin, 2010). Therefore, the met6hoidology and design is impacted by the frameworks and hypotheses of this research from Section 3 above. This section will cover the choice of methodology, research population, unit of analysis, sampling methodology, measurement instruments used in the survey and the data analysis.

4.1. CHOICE OF METHODOLOGY

The choice of methodology is influenced by the philosophy of the researcher, and influences the research approach and strategy (Creswell, 2012; Saunders, Lewis, & Thornhill, 2009). The methodology will cover the researchers chosen philosophy and approach, the strategy and choices, as well as the time horizon of the research and the chosen techniques and procedures.

4.1.1. Philosophy

The chosen philosophy for this research is *pragmatism*, as this is a research approach that argues that the most important determinant of the research philosophy adopted is the research questions and objectives (Saunders & Lewis, 2012). In other words, using procedures that "work" for the particular research problem (Creswell, 2012). As pragmatism evaluates theories or beliefs regarding the success of their practical application and applies a method that advances the specific research in the best possible manner, it is the researcher's view that it is a logical and defendable approach for this research (Dudovskiy, 2013).

4.1.2. Approach

The approach of this research is that of *deduction*, as it involves the testing of theoretical propositions, and will attempt to explain the causal relationships between variables (Saunders & Lewis, 2012). Deduction can be motivated as the appropriate approach for this research as quantitative research is more deductive in approach (Creswell, 2012; Greener, 2008), and the research question involves mediation and hypothesis testing (Dudovskiy, 2013). Deduction research that establishes the mechanisms by which effects operate and that facilitate and inhibit such effects deepen our understanding of the phenomena (Hayes, 2013).

4.1.3. Strategy

As the research looked for relationships between key variables, it is an *explanatory* study (Saunders & Lewis, 2012). The explanatory research design is a correlation type research, where the variance in one variable and its effect on the variance of another variable is the point of interest (Creswell, 2012). As explanatory research is conclusive in nature, which tends to be deductive and use statistical tests and advanced analytical techniques, it is the researcher's view that it is the correct choice for the research question (Creswell, 2012; Dudovskiy, 2013). Secondary data collected by a self-administered online survey, for the

specific purpose of the research question, was available for statistical analysis and hypothesis testing.

4.1.4. Choices

Only survey data will be used, and thus *mono method quantitative* is the choice for this research. A survey allows for the structured collection of data from a sizeable population, which can then be statistically analysed (Saunders & Lewis, 2012). A survey also allows a broad and large audience to be reached, in a cost-effective manner (Zikmund et al., 2010). As secondary data from surveys were collected for specific use for the research question a mono-method with statistical analysis would be the appropriate choice.

4.1.5. Time Horizon

The research problem was studied from data collected over one period, and is, therefore, a *cross-sectional research design*. Although longitudinal studies in leadership are preferred, due to the nature of leadership development (Day et al., 2014), the time constraints for the research project for the MBA course will not allow for longitudinal data collection, and is therefore cross-sectional.

4.1.6. Techniques & Procedures

This is a *quantitative study,* as secondary data from the surveys were statistically analysed. As the research questions involve multiple independent and dependent variables, a multivariate statistical analysis was done (Zikmund et al., 2010). This analysis was in the form of dependence techniques, and Structural Equation Modelling (SEM), as this technique can predict or explain one or more dependent variables (Zikmund et al., 2010). SEM offers advantages over multiple regression methods, as it accommodates for measurement error, and therefore makes SEM approaches for mediation superior to others (Cheung & Lau, 2008; Strasheim, 2014).

4.2. RESEARCH POPULATION

A population is defined as a complete set of group members who comprise the same characteristics (Creswell, 2012; Saunders & Lewis, 2012). Population parameters are its measurable characteristics, and the population of a random variable is the collection of all possible data values (Wegner, 2016). The population parameters of concern were contextual ambidexterity, complexity leadership and organisational innovation climate, in firms operating in South Africa. These parameters (or constructs) can be applied to any operating environment, and thus all members will have exposure to one or more of the constructs (Zikmund et al., 2010). Therefore, the population was defined as employee organisations operating in South Africa. The control variables of size and nature of the organisation, and respondents level of management, were used to contextualise the results but did not disqualify any organisation or individual.

4.3. UNIT OF ANALYSIS

The unit of analysis in a study indicates who or what should provide the data and at what level of aggregation (Zikmund et al., 2010). As members of a population can be defined as the unit of analysis (Welman, Kruger, & Mitchell, 2005), respondents responses were the unit of analysis for this study. These relate specifically to the objectives of the research as mentioned in the research problem above and allowed for the determination of the relationships between, and the mediating effect, of the constructs.

4.4. SAMPLING

The researcher used secondary data. The research supervisor who collected the data granted access to this data and shared all relevant and important information regarding the sampling methodology and research measurement instrument. Respondents were made aware that the data collected would be used by GIBS and its students or faculty for research purposes. The secondary data was classified as quantitative data from an Ad hoc survey (Saunders & Lewis, 2012). The advantages of using secondary data include data is immediately accessible and available, data collection is unobtrusive and analysis is in a "friendly" format. (Saunders & Lewis, 2012; Zikmund et al., 2010). There are however disadvantages to secondary data; this will be discussed in the limitations section below. Sampling involves the sampling methodology and technique, and the sample size, as detailed below.

4.4.1. Sampling Methodology & Technique

Zikmund et al., (2010) define sampling as "any procedure that draws conclusions based on measurements of a portion of the population" (p.68). Sampling was done as it is not practical to collect data from the whole population, which calls for a subset of values (Saunders & Lewis, 2012; Wegner, 2016). The sample must also be representative of the target population so that conclusions can be drawn about the population as a whole (Creswell, 2012). Therefore, sampling was done for practical reasons, and the researchers targeted individuals who represented the target populations.

The sampling technique used was a two-layered non-probability technique, which included convenience and snowball sampling (Saunders & Lewis, 2012). Convenience sampling is extensively used and has a very low cost, with the advantage that no population list is needed, but its disadvantages are that unrepresentative samples are likely and random sampling errors estimates cannot be made (Zikmund et al., 2010). Snowball sampling is also inexpensive and useful for locating members of the same target population but may have a high bias as sample units are not independent (Zikmund et al., 2010).

MBA students distributed the online survey to colleagues in their organisations (convenience sampling), who were requested to then send the survey onto others within the organisation (snowball sampling). This data was initially used in the MBA syndicate groups for assignments, and then combined to into a one large data set. The research supervisor granted

the researcher access to the collected data. As the MBA class is composed of a diverse set of individuals from various organisations and industries, a variety of organisations with differing size, type and industry were sampled.

4.4.2. Sample Size

When looking at sampling size, larger is more precise than smaller; this is due to the law of large numbers and central limit theorem (Greener, 2008; Zikmund et al., 2010). Additionally, a larger sample size will also more closely represent the population (Burns & Burns, 2008). Secondary data will often have a larger sample size, and quantitative studies place emphasis on a large sample size (Kumar, 2014). The sample size from the secondary data is 1324 responses to the survey. This sample size is large, and due to its size has a very low percentage of a maximum value of sampling errors of 3% (Fowler, 2014). A large sample size does have some drawbacks in structural equation modelling analysis, and the researcher addresses this below in Section 5.2.1.4.

4.5. MEASUREMENT INSTRUMENT

Secondary data was collected utilising a uniquely designed and self-administered electronic survey, which is a typical method used in Explanatory studies (Saunders & Lewis, 2012). Surveys can provide information that is accurate, quick and inexpensive to obtain, and can be applied to a variety of objectives (Zikmund et al., 2010). Electronic surveys also have the advantage of limited interviewer bias, extensive geographic reach and reduced capturing errors (Wegner, 2016). The survey was piloted and then improved. Ethical clearance was granted for distribution. The survey consisted of the following four parts:

4.5.1. Participation Consent

Informed consent was obtained at the beginning of the questionnaire, that stated voluntary participation, the right to withdraw, anonymity, the procedures and that there were no known risks to participating (Creswell, 2012). Information about the investigator was also supplied. This consent followed fundamental ethical principles for managing the research process (Saunders & Lewis, 2012)

4.5.2. Biographical Information

The questionnaire includes basic biographical information in six questions that covered age of respondent, gender, the level of education, race group, tenure at the organisation and the discipline of work (e.g.: finance, marketing, operations). Descriptive statistics were applied to this data.

4.5.3. Control Variables

Four control variables were included in the questionnaire covering the level of management, size and age of the organisation, and whether the organisation is bureaucratic or entrepreneurial. A control variable is measured in correlation type studies as a special type of independent variable of secondary interest, which is neutralised through statistical procedures

(Creswell, 2012).

4.5.4. Independent, Dependent & Mediator Variables (Constructs)

The remainder of the questionnaire focused on the constructs of complexity leadership, organisational innovation climate and contextual ambidexterity.

Respondents rated a list of questions using a Likert-type scale, featuring five anchors, from strongly disagree to strongly agree. The ordinal answers were coded numerically from 1 to 5. The Likert scale, which can be used in statistical analysis, and is well tested (Creswell, 2012), has theoretically equal intervals among responses.

As noted earlier these variables will be referred to as constructs for the purpose of this research, as they are abstract concepts that are not easy to measure and not stated in a specific or applied way (Creswell, 2012). Thus, construct measurement scales are used so that respondents to the questionnaire can try to quantify these theoretical constructs, and allow the researcher to measure them (Bagozzi & Yi, 2012).

These scales are detailed below.

4.5.5. Construct Measurement Scales

The definitions of the constructs have been provided in the literature review. These constructs are contextual ambidexterity, complexity leadership and organisational innovation climate. It is essential that these definitions match the measurement scales, and to know the precise definitions used in the secondary data (Saunders & Lewis, 2012). These definitions stipulate how the constructs are defined and allow for their measurement (Burns & Burns, 2008; Creswell, 2012). The questionnaire is shown in Table 27: Research questionnaire in Appendix A.

4.5.5.1. Contextual Ambidexterity

These constructs were measured using existing multi-item scales from the work of Jansen, Bosch and Volberda (2006) and were verified in their research for reliability and validity (Jansen et al., 2006, 2009). The scales were created in 2006 for measurement on a business unit level and adapted in 2009 for an organisational level.

This research investigates contextual ambidexterity, a combination of exploitative and exploratory innovation, conceptualised as a construct by Gibson and Birkinshaw (2004). The use of a single variable to measure exploration and exploitation is advocated by Lavie et al.(2010). However, Gibson and Birkinshaw (2004) used two measurement scales during analysis to represent contextual ambidexterity. Other authors have followed this method and showed that ambidexterity can be measured by the multiplicative interactions between exploitation and exploration (De Clercq, Thongpapanl, & Dimov, 2014; Nemanich & Vera, 2009). Therefore, exploitation and exploration are two separate factors, which when combined measure contextual ambidexterity. The researcher followed this method, and analysed exploitation and exploration as two variables in the structural equation model, to represent contextual ambidexterity. The researcher also felt that this would add to the results and discussion, to investigate the relationships complexity leadership and organisational

innovation climate has on exploitation and exploration. As the literature on complexity leadership and innovation is lacking (Mendes et al., 2016), analysing the relationships of this leadership style on exploitation and exploration, and conceptually combined, will add to the insights and possibly guide future research.

4.5.5.2. Organisational Innovation Climate

No standard scales are available to measure organisational innovation climate. Six statements were developed by the creators of the questionnaire from the work of Arena and Uhl-Bien (2016) that covered the construct. The six statements covered the concepts discussed in the literature review in Section 2.3. These statements were verified for reliability by the creators of the instrument, with high Cronbach alphas, factor analysis through rotation and exploration adequate discriminant, and convergent validity, see Table 28: Reliability statistics organisational innovation climate in Appendix A. The researcher also performed reliability analysis, as per the results section below.

4.5.5.3. Complexity Leadership

No standard scales are available to measure complexity leadership. This construct was asked using the three sub-constructs of patterning of attention, developing networks, and contextual intelligence, which have known scales, as described above in the literature review.

- **Patterning of Attention:** The work of Osborn and Marion (2009) was used to develop a six-item scale. The researchers inferred items from Osborn's articles as the original scale was unavailable. Patterning of attention results in higher innovation performance and involves leaders working with subordinates to discover what information is important (Osborn et al., 2002; Osborn & Marion, 2009).
- **Developing networks:** Six statements were developed that are supported by Osborn and Marion (2009) and Uhl-Bien, Marion and McKelvey (2007). The authors state the importance of networks to be created to connect subordinates to a broad variety of information sources and bridge internal organisational boundaries and functions (Osborn & Marion, 2009; Uhl-Bien et al., 2007). Developing networks forms part of the CLT framework under adaptive leadership as mentioned in the above literature review.
- **Contextual Intelligence:** The work of Kutz (2008) was used to develop seven statements from the 12 meta-competencies making up the construct of contextual intelligence. Kutz and Bamford-Wade (2013) describe a contextually intelligent leader as one who "appropriately interprets and reacts to changing and volatile surroundings" (p.20).

All the scales used to collect data on these sub-constructs of complexity leadership were verified for reliability by the creators of the instrument, with high Cronbach alphas, factor analysis through rotation and exploration adequate discriminant, and convergent validity, see Table 29 in Appendix A. The researcher, however, performed his own reliability and validity analysis, and exploratory factor analysis as per the results section below.

This section covered the methodology and design, and the measurement instrument. The next section will explain the data analysis of the secondary data, and the next steps the researcher took.

4.6. DATA ANALYSIS

This section will discuss the data analysis done by the researcher. Data analysis was conducted by the researcher in the order of the steps he identified. These steps were preliminary analysis (data preparation, descriptive statistics and exploratory factor analysis), and structural equation modelling (SEM) and mediation analysis for hypothesis testing. The steps and statistical methods used are summarised in Table 1 below, and discussed further thereafter. Table 2 below lists the acronyms used for the constructs.

Table 1: Data analysis steps

Steps	Description	Purpose	Methodology & analysis
Preliminary Analysis: Data preparation, descriptive stats and factor analysis			
Data Preparation	Data editing	- Remove outliers & missing data points	• Mahalanbois distance
	Normality Testing	- Establish normality of data	• Skewness • Kurtosis
Descriptive Statistics	Descriptives stats	- Relevant descriptives	• Frequency • Percentage
Exploratory Factor Analysis	Principal Component Analysis (PCA)	- Suitability of data for factor analysis	• Kaiser-Meyer-Olkin • Bartlett's test of Sphericity
		- Determine numbers of factors to analyse	• Keiser Eigenvalues • Cattell's Scree plot
		- Confirm factors of CL, Xplo, Xploi & OIC	• Principle component analysis (PCA) • Orthogonal rotation (Varimax)
Structural Equation Modelling: analyse the relationships between constructs			

Measurement Model	Factor Analysis	- Determine which variables load onto which constructs from the instrument scales	• Confirmatory Factor Analysis (CFA)
			  ○ Factor Loading
			  ○ Correlation Estimates

	Validity of scales	- Confirm validity of scales used	• Convergent Validity
			  ○ AVE
			• Discriminant Validity
			  ○ MSV
			• Correlation & Square root of AVE matrix

	Reliability of scales	- Confirm reliability of scales used	• Cronbach Alpha • Composite Reliability Coefficient
	Model Fit Analysis	- Confirm measurement model fits the data	• Range of model fit indices
Structural model	Model Fit Analysis	- Confirm structural model fits the data	• Range of model fit indices
	Hypothesis Testing	- Determine if model supports hypothesis	• Path estimate (Regression weight coefficients) • Variance Explained
Mediation Analysis	Mediation Analysis	- Determine if OIC is a mediator	• Bootstrapping

The notations used throughout the analysis are found below in Table 2 for reference.

Table 2: Data labels

Acronym	Construct (Latent variable)
CL	Complexity leadership
Xploi	Exploitation
Xplo	Exploration
OIC	Organisation innovation climate
Acronym	**Item (Observed variable)**
PA	Patterning of attention
DN	Developing networks
CI	Contextual intelligence
Xploi	Exploitation
Xplo	Exploration
OIC	Organisational innovation climate

In Table 3 below, the variables (constructs) are classified as per the research objectives (see Figure 6 above). This gives the reader and researcher clarity on the relationships being analysed and the variables involved.

Table 3: Variable classification as per research objectives

Objective 1	**Independent Variable**	**Dependent Variable**	
	Complexity leadership	Organisation innovation climate	
Objective 2	**Independent Variable**	**Dependent Variable**	
	Complexity leadership	Contextual ambidexterity	
Objective 3	**Independent Variable**	**Dependent Variable**	
	Organisation innovation climate	Contextual ambidexterity (exploitation & exploration)	
Objective 4	**Independent Variable**	**Mediating Variable**	**Dependent Variable**
	Complexity leadership	Organisation innovation climate	Contextual ambidexterity

4.6.1. Preliminary Analysis

The researcher has access to all 1324 responses, which are in a single excel file. Quantitative data requires three processing steps: editing, coding and the analysis (Kumar, 2014). The secondary data had already been coded as the responses were captured electronically as coded numerical data.

4.6.1.1. Data Preparation

Data Editing

Editing refers to 'cleaning' of the data, by addressing inconsistencies. These may include typographical errors, outliers and out-of-range values, and addressing them increases data quality before analysis is done (Wegner, 2016). Due to the nature of the electronic survey,

typographical and out-of-range values will not be found in the data, but missing values and outliers are expected. The researcher had to decide whether to delete, replace or use robust statistical procedures to accommodate the missing data points, as these missing values and outliers would affect the statistical analysis (Schumacker & Lomax, 2010). Common practice is to replace the missing values, as this does not decrease the data size, and the best method to replace the missing values depends on sample size and the SEM software being used (Davey & Savla, 2010; Schumacker & Lomax, 2010).

Due to the large sample size, the missing data values and outliers were deleted. Outliers were identified using Mahalanbois Distance in AMOS. Mahalanbois Distance is a measure that indicates whether an observation is an outlier concerning the independent variables values (Hill & Lewicki, 2006). The Mahalanbois Distance measures the distance of an observation from the mean (centroid), and if this distance is too large it is considered an outlier (Hill & Lewicki, 2006).

Once the data was scrutinised, and the number of missing points and outliers was determined and deleted, further analysis was done. The edited data then went through normality testing.

Normality Testing: Skewness & Kurtosis

To treat the Likert data from the research questionnaire as interval data, the researcher determined if the data was normally distributed (Creswell, 2012). When looking at SEM, a minimum sample size of 100 is suggested, and greater than 500 for a robust model fit (Lei & Lomax, 2005). The sample size after editing was 1204, and is, therefore, more than adequate. However the Chi-square is overly sensitive to models that have large sample sizes (Credé & Harms, 2015), therefore the researcher conducted additional model indices. The effect on non-normal data on the SEM parameters are negligible, and at worst 10% (Lei & Lomax, 2005).

Normality was tested for using Kurtosis and Skewness formulae in AMOS. Hair et al. (2010) suggest that data is considered to be normal if Skewness is between -2.58 to +2.58 and Byrne (2010) if Kurtosis is between -7 to +7.

4.6.1.2. Descriptive Statistics

The biographical information and control variables were used as basic descriptive statistics. Descriptive statistics summarise and describe data in a simple manner, and provide insight (Creswell, 2012; Zikmund et al., 2010) by providing statistics on central tendency, variability and relative standing (Creswell, 2012).

4.6.1.3. Exploratory Factor Analysis

The objective of factor analysis is to condense the information obtained from variables into a smaller set of factors with the minimal loss of information (Hair et al., 2010). This is done by grouping highly interrelated variables. In this process, factor analysis helps the researcher to determine which sets of observed variables share characteristics that define theoretical

constructs (Schumacker & Lomax, 2010). Factor analysis can confirm that a subset of observed variables defines the construct, or explore which variables do (Schumacker & Lomax, 2010). Therefore the researcher was trying to confirm that the observed variables actually defined the construct wanting to be measured, and if not, explore which ones did (Schumacker & Lomax, 2010).

Exploratory Factor Analysis (EFA) is used as a standard technique for evaluating measurement models and refers to a class of procedures that include principal components and principal factor analysis (Kline, 2011). EFA allows all variables to load on every factor (Kline, 2011), and therefore tests which observed variables belong to which factor. EFA was the appropriate technique for the researcher to use, as the data collected is based on a theoretical model (Hair et al., 2010). EFA also helped the researcher determine if the scales used to measure complexity leadership and organisational innovation climate, which are untested scales, did in fact load onto the constructs and measured what the researcher was trying to measure.

Three steps were followed in performing the factor analysis, as described by Pallant (2011). These steps and the thresholds/ranges prescribed are detailed in Table 4 below.

Table 4: EFA steps

EFA Steps	Method		Thresholds/Ranges
1. **Suitability of data:** to measure if the data is suitable for factor extraction	**Kaiser-Meyer-Olkin (KMO)** measure of sampling adequacy		**Above 0.6** (Pallant, 2011)
	Bartlett's Test of Sphericity must be significant to continue with factor analysis		**Significant (p<0.5)**
2. **Factor extraction:** to determine the smallest number of factors that best represent the interrelationships of the variables. Researcher must adopt exploratory approach until satisfactory solution is found	**Principle Component Analysis (PCA)**	**Kaiser's criterion:** to measure the total variance explained	**Eigenvalue > 1**. These factors will be retained. This method has been criticised as retaining too many factors, hence another step is done.
		Total Variance Explained: to measure the total variance explained	**60%>.** Components that contribute to more than 60% of total variance explained are considered satisfactory

3. **Factor rotation & interpretation:** extract components that maximise the variance explained.	**Principle Component Analysis (PCA)**	**Varimax Orthogonal Rotation:** Most common orthogonal approach, minimises the number of variables that have high loading on each factor	**Items are associated with components which with it has the highest loading.**

(Adapted from Hair et al., 2010 & Pallant, 2011)

Once the preliminary analysis was done, the researcher continued with the data analysis. The next step of the analysis was SEM, and this was used to confirm the factors extracted from the steps described above (Hair et al., 2010).

4.6.2. Structural Equation Modelling

Structural Equation Modelling (SEM) was the next step in the data analysis and was the primary technique used to test the research hypothesis. "SEM is a multivariate technique that considers and estimates the linear and/or causal relationships between multiple exogenous (independent) and endogenous (dependent) constructs through a simultaneous, multiple equation estimation process" (Babin & Svensson, 2012, p. 321). SEM emerged in the 1970's, and in recent times has gained a place as one of the most widely used tools (Babin & Svensson, 2012; Svensson, 2015). Its popularity can be attributed to the user-friendly software, literature providing clear guidelines for usage, and its ability to possibly move theory to a new level of understanding (Babin & Svensson, 2012).

When the researcher has hypotheses that define independent and dependent variables, dependence statistical techniques are needed (Zikmund et al., 2010). SEM is a dependence method, that uses different multivariate techniques (e.g. factor and regression analysis) (Babin & Svensson, 2012; Schumacker & Lomax, 2010; Svensson, 2015; Zikmund et al., 2010).

SEM can be used to test theoretical models that define constructs, and the relationship between those constructs (Schumacker & Lomax, 2010), and therefore, suited this research as the conceptualised models of the researcher could be tested. Additionally SEM has various advantages: it takes measurement error into account (Schumacker & Lomax, 2010), is more powerful and sophisticated than multiple regression (Hoyle, 2014), and provides results in an intuitively pleasing way (Babin & Svensson, 2012). SEM also analyses multiple relationships between constructs, the complexity of perceptions, and keeps the context in focus (Babin & Svensson, 2012). These factors are consistent with the research theme, as seen in the conceptualised model developed by the researcher (Figure 5 above). The dependent variable of contextual ambidexterity was analysed as two variables, exploitation and exploration, as supported by the literature (Gibson & Birkinshaw, 2004), and analysed to represent contextual

ambidexterity. This approach is shown in Figure 5 above, the conceptual model, and as was explained in methodology section 4.5.5.1 above.

4.6.2.1. SEM Steps

Literature has identified and recommended six steps in the SEM process (Hair et al., 2010; Svensson, 2015):

i) define the constructs: as done in the literature review and conceptual models.

ii) develop the measurement model (instrument): this was done with the conceptual models created by the researcher, and the measurement scales.

iii) design a study to produce empirical results: here the data collected was analysed for sample size and missing values, as done in the preliminary analysis described above.

iv) assess the measurement model validity: the relationships between variables were defined, and the CFA model assessed factor loading. If the model is valid, one can proceed to the structural model

v) specify the structural model: convert measurement model to structural model.

vi) assess the structural model validity: assess the size, significance and direction of the relationships. Use these to draw substantive conclusions and recommendations.

As seen from the steps above, two clear sub-models are described (Byrne, 2010; Hair et al., 2010; Kline, 2011):

- the measurement model: represents the CFA model and factor loading
- the structural model: defines the relationships and influences of variables.

These two models and their analysis steps, as seen in Table 1 above, are explored in their sections below.

4.6.2.2. SEM Output

There are elements of the SEM output that are common to both the measurement and structural models. These outputs are explained below, before moving onto the specific elements expected from each model.

SEM Graphical output

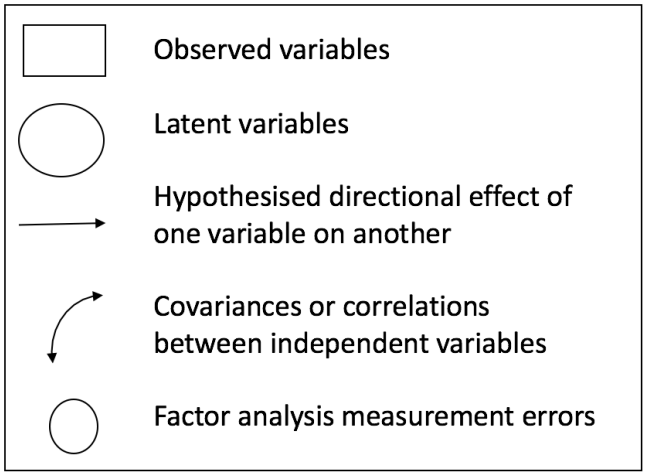
SEM provides results in an intuitively pleasing way (Babin & Svensson, 2012), and can be illustrated graphically (Bagozzi & Yi, 2012). Both models can be shown graphically, and this is done using the McArdle-McDonald Reticular Action Model (RAM) described by McArdle and McDonald in 1984 (Kline, 2011).

The graphical elements are as follows, and are shown below in Figure 8:

- Observed variables with squares or rectangles
- Latent variables with circles or ellipses
- Hypothesised directional effects with a single arrowhead line

- Covariances or correlations with a double arrowhead curved line
- Measurement errors by smaller ellipses

Figure 8: SEM graphical elements



Correlation Estimates

These estimates, shown with the double arrowhead as explained above, represent the standardised covariance between two variables (or constructs) and are interpreted as the regressions coefficients of each relationship (Hair et al., 2010). The figure shown on the graphical output gives an idea of the strength of the correlation of the constructs, and the matrix that is also provided as an output, adds the significance of this correlation (Hair et al., 2010). In essence what is being addressed is the strength of the correlations between constructs, and is it significant and concerning?

Model Fit Analysis

Both models were assessed for model fit, using a model fit analysis. Kline (2011) suggests that the appropriate chi-square statistic, degrees of freedom and p-value should always be reported. A model can only be valid if an acceptable goodness-of-fit is established (Hair et al., 2010). Model fit indicates how well the data is explained by the model and is it considered good practice to report a range of fit indices (Kline, 2011). The indices that are reported by the researcher and the thresholds values are shown in Table 5 below, adapted from Hair et al. (2010).

Table 5: Model fit indices and thresholds.

Type	Measure	Threshold
Absolute fit indices	Chi-square (χ^2) / degree of freedom (CMIN/df)	< 3 good; < 5 sometimes acceptable
	Goodness-of-Fit-Index (GFI)	>.80 sometimes acceptable; >.90 good
	Root Mean Square Error of Approximation (RMSEA)	<.05 good; .05 to .1 moderate; >.1 bad
Incremental fit indices	Tucker Lewis Index (TLI)	>.80 sometimes acceptable; >.90 good
	Comparative Fit Index (CFI)	>.80 sometimes acceptable; >.90 good

Adapted from (Hair et al., 2010)

4.6.2.3. SEM - Measurement Model

Factor Analysis

The measurement model in SEM represents the factor analysis of the data, and this is done using Confirmatory Factor Analysis (CFA) (Byrne, 2010). CFA is a more complex and sophisticated set of techniques compared to EFA, that is simplified by the AMOS software (Byrne, 2010; Pallant, 2011). CFA analyses a measurement model where the number of factors and items loading onto those factors are known and specified (Hair et al., 2010). So, the researcher used the results from the EFA done in the preliminary analysis and specified the constructs and factors that load onto those constructs. CFA then provided the measurement contribution of each item in the construct, indicated by its factor loading estimate (Hair et al., 2010; Kline, 2011). These factor loadings are a statistical estimate of the causal effects of the latent variable on the observed scores and are interpreted as regression coefficients (Kline, 2011); basically addressing how much does that factor measure the construct? CFA also provided the correlation estimates of the constructs in the model, showing how closely correlated constructs are to each other.

Factor loading estimates should measure at 0.5 or higher, and ideally 0.7 or higher, and be statistically significant (Hair et al., 2010). Correlation estimates should be below 0.7 and be statistically significant. These figures are shown graphically in the SEM measurement model, and in a table to analyse the significance.

Validity

Validity is the accuracy of a measure, as to how it measures the intended concept or construct, and therefore the extent to which research is accurate (Hair et al., 2010; Zikmund et al., 2010). Simply put, are we measuring what we think we are measuring? Multivariate procedures, such as factor analysis, are used to determine validity (Creswell, 2012; Zikmund et al., 2010).

Construct validity is explored by investigating whether that construct is both related (convergent validity) or unrelated (discriminant validity) to other constructs (Pallant, 2011). For SEM Fornell and Larcker (1981) developed a measuring system for the structural and measurement model, which measures both convergent validity and discriminant validity. Convergent validity occurs when the set of variables presumed to measure a construct do in fact measure said construct, and therefore the researcher looked for high scores of above 0.5 (Hair et al., 2010; Kline, 2011). In contrast discriminant validity is the extent to which a construct is truly distinct from other constructs, and the researcher considered values that are low, and ideally lower than that measured for convergent validity (Hair et al., 2010; Kline, 2011).

Convergent Validity: Average Variance Extracted: convergent validity was measured for the SEM model using the Average Variance Extracted (AVE). AVE measures the amount of

variance in a construct in relation to the amount of variance due to measurement error (Fornell & Larcker, 1981). The AVE is calculated using the construct factor loadings. AVE scores of above 0.5 are considered acceptable (Hair et al., 2010; Hair, Sarstedt, Hopkins, & G. Kuppelwieser, 2014)

Discriminant Validity: Maximum Shared Squared Variance (MSV): MSV is calculated for a construct using the maximum shared variance of a construct and squaring that value (Hair et al., 2010). Fornell and Larcker (1981) recommended that AVE should be compared with corresponding correlation variables, such as MSV. The value of MSV coefficient for a construct should be lower than the AVE to establish discriminant validity (Hair et al., 2010). The logic behind this is that the variance should be explained more by the construct measures than by what its shares with other constructs (Hair et al., 2010). If the MSV is greater than the AVE for a construct an extra step is required, which compares the square root of AVE of the construct with the corresponding correlation values to the other constructs in the model (Hair et al., 2010). This step is in fact advised as normal practice in SEM (Hair et al., 2010, 2014; Hoyle, 2014).

Correlation & Square root of AVE's Matrix: as briefly described above, here the square root of the AVE for a construct is compared with the correlations estimates of all other constructs in the model (Hair et al., 2014). The square root of AVE should be greater than the correlations estimates to prove there is no discriminate validity concern (Hair et al., 2010, 2014; Kline, 2005).

Once validity is confirmed, the reliability measures are performed.

Reliability

Reliability is the extent to which the data collection method and analysis produce consistent findings, and therefore the degree to which measures are free from error (Saunders & Lewis, 2012). Reliability revolves around the concept of consistency and is an indicator of internal consistency (Zikmund et al., 2010). Good research should have measures that are reliable and consistent (Creswell, 2012).

For this research, the reliability measures of Cronbach's Coefficient Alpha and the Composite Reliability (CR) Coefficient were used.

Cronbach's Coefficient Alpha: When items are scored as continuous variables, as the data for this research is (strongly disagree to strongly agree), coefficient alpha was used to test for internal consistency, also known as Cronbach's alpha (Creswell, 2012). The three constructs of this research were measured with multi-item scales. Multi-item scales allow for decreased measurement error and are more reliable than single item scales (Gliem & Gliem, 2003). The most commonly applied estimate of a multi-item scale's reliability is the coefficient alpha (Zikmund et al., 2010). Coefficient alpha ranges from 0 (no consistency) to 1 (complete

consistency), with values below 0.6 showing poor reliability, and above 0.8 very good reliability (Zikmund et al., 2010).

Composite Reliability (CR) Coefficient: Composite Reliability is a method used in SEM to strengthen the reliability analysis, as Cronbach's Alpha has been found to underestimate true reliability (Peterson & Kim, 2013). Variance components can be estimated using SEM, providing the true reliability, and is referred to as CR (Peterson & Kim, 2013). Cronbach Alpha is a constrained version of CR, and thus estimates of reliability are on average larger when using CR (Peterson & Kim, 2013). CR values of 0.6 – 0.7 may be acceptable, with scores higher than 0.7 suggesting good reliability (Hair et al., 2010)

A summary of the steps and thresholds values for analysis of the measurement model, described above in section 4.6.2 Structural Equation Modelling, are shown in Table 6 below (Hair et al., 2010, 2014; Zikmund et al., 2010):

Table 6: SEM measurement model steps

SEM Measurement model steps			
Step	**Method**		**Thresholds/Ranges**
Factor Analysis	CFA	Factor Loadings	Acceptable: > 0.5 Ideal: > 0.7
		Correlation Estimates	< 0.7
Validity	Convergent Validity	AVE	> 0.5
	Discriminant Validity	MSV	AVE > MSV
	Correlation & Square root of AVE's Matrix		Square root of AVE > Correlation
Reliability	Cronbach's Alpha		> 0.8
	CR Coefficient		Acceptable: 0.6 – 0.7 Good: > 0.7
Model Fit Analysis	(See Table 5 above)		

(Adapted from Hair et al., 2010, 2014; Zikmund et al., 2010)

With the measurement model steps complete and the model found to be valid, the structural model follows (Kline, 2011).

4.6.2.4. SEM - Structural Model

As with the measurement model, the structural model output is graphically shown and must be assessed for model fit (Kline, 2011). The measurement model and structural model can be described as equivalent, and as such many of the analysis outputs and figures (model fit indices, covariance's, factor loadings) were identical, and thus only the estimates unique to the structural model were assessed and interpreted (Kline, 2011). A vital difference between the models is that the structural model analyses the nature and magnitude of the relationship

between constructs, whereas the measurement model was the relationship between latent constructs and variables (Hair et al., 2010).

The structural model depicts links between the constructs and defines the relations among these constructs, as well as the direct or indirect influence they have on each other (Byrne, 2010). These relationships are shown as path estimates, which is the SEM equivalent of a regression coefficient (Hair et al., 2010). A path estimate measures the linear relationship between an independent variable and dependent variable (Hair et al., 2010), and was thus used to test the research objectives and hypothesis. The significance of these path estimates was also determined.

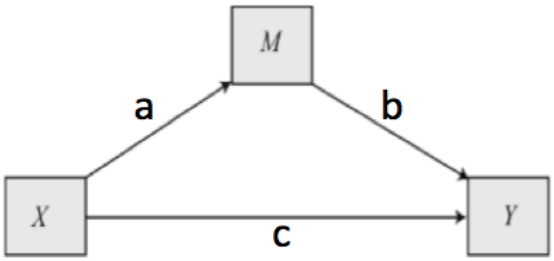
The next step was mediation analyses as conceptualised by the researcher.

4.6.2.5. Mediation Analysis

The mediation analysis was done in the SEM software and required model specification (Schumacker & Lomax, 2010). SEM offers advantages over multiple regression methods, as it accommodates for measurement error, and therefore makes SEM approaches for mediation superior to others (Cheung & Lau, 2008; Strasheim, 2014). The mediating construct of organisational innovation climate was analysed.

Mediation analysis looks at the direct effect of an independent variable on a dependent variable, as well as the indirect effect through a mediating variable (Hayes, 2013). The mediation model shows a casual sequence where (see Figure 9) independent variable (X) affects dependent variable (Y) indirectly through the mediator variable (M).

Figure 9: A simple mediation model



It is therefore postulated that X affects M (path *a*), and then this affect propagates causally through to Y (path *b)* (Hayes & Preacher, 2014). This represents how X indirectly transmits its effect on Y. Per the model X can also affect Y directly (path *c*). Mediation analysis is used to quantify the direct and indirect pathways through which variable X transmits its effect on dependent variable Y through one or more mediator variables (Hayes & Scharkow, 2013). For mediation to be established the four criteria of Baron and Kenny (1986) was used. These four criteria are (Baron & Kenny, 1986): firstly, the independent variable must have an effect on the dependent variable; secondly, the independent variable must have an effect on the mediator variable; thirdly, the mediator variable must have an effect on the dependent variable; and finally, the mediator variable must have a significant effect on the dependent

variable when the independent variable and mediator variable are added to the model. The independent's variables effect on the dependent variable should, therefore, lessen or vanish entirely (Baron & Kenny, 1986).

Current literature supports the use of a bootstrapping method for mediation analysis in SEM (Hair, Hult, Ringle, & Sarstedt, 2016). Bootstrapping is a resampling technique where a large number of subsamples are drawn from the original data, and estimates models for each subsample (Hair et al., 2014). Bootstrapping methods are available in SEM software for estimating the indirect effects of variables (Hayes & Preacher, 2010), and this methodology performs best in testing for mediation effects (Cheung & Lau, 2008). The number of resamples was set high at 2000, as suggested by literature (Cheung & Lau, 2008).

With the data analysis approach explained, the next section discusses the limitations of this research with regards to the methodology chosen.

4.7. LIMITATIONS

All research has limitations. These limitations can include the size of the data sample, the time frame, one geographical area, and data analysis (Zikmund et al., 2010). For quantitative research, the limitations are usually related to research design, data collection and analysis (Creswell, 2012). Limitations with regards to the research topic and constructs must also be addressed; which is dealt with later in section 7.3 Limitations. The limitations with regards to this research method and data follows.

Secondary data was used by the researcher. Secondary data has disadvantages that include validity of data, purpose of original data, population used, definition of terms, and accessibility (Saunders et al., 2009; Zikmund et al., 2010).

In using secondary data, there is no control of how the survey items were framed and worded (Vartanian, 2010). The measurement instrument measured specific constructs, and therefore other important influencing factors may be excluded. The researcher, therefore, did not have control of the constructs included, even though the instrument was designed with the research problem in mind, new literature may identify constructs that are relevant but will not be able to be added and measured (Wegner, 2016).

Data collected was cross-sectional, and the research will also be cross-sectional in nature, which may not allow for the depth that a longitudinal study would contribute. The data may also be aged, and therefore not as relevant as more recent data (Wegner, 2016).
The data collection was in an electronic format, only individuals with the technology that allows for a response could be targeted. With electronic surveys the respondent is unable to gain

clarity on the question asked and may interpret the question incorrectly; respondents often respond as they think the researcher wants them to, rather than being honest (Zikmund et al., 2010)

Sampling error is also a noteworthy limitation to consider (Wegner, 2016). As non-probability sampling was used, namely convenience and snowball sampling, only certain individuals and organisations were targeted, and this may result in a population that is unrepresentative of the true population. The context of the study is in South African organisations, and this may limit the applicability to a broader international context.

This research has a pragmatic and explanatory approach. It can be argued that a mixed method approach may be more suited to pragmatism, and can then also be explanatory (Dudovskiy, 2013). An explanatory approach may add more to theory and provide a higher level of insights to guide further research. The researcher is also inexperienced in academic research, and thus the scope and depth of insights of this research could possibly be expanded

The data analysis technique must also be critically reviewed. Although SEM has gained much popularity as a method in recent literature, its value and applicability have been challenged (Babin & Svensson, 2012; Svensson, 2015). It must also be accepted that full mediation cannot be measured or claimed by the research, to claim full mediation all possible mediators and suppressors have to be measured (Rucker, Preacher, Tormala, & Petty, 2011). The measurement instrument used a five (5) point Likert scale, and as the accuracy of measuring the relationships of the constructs increases as the range of the constructs increases, this limited range will reduce the SEM output precision (Schumacker & Lomax, 2010).

4.8. CHAPTER CONCLUSION

This chapter described the research methodology used by the researcher to answer the research objectives, and test the hypotheses. The choice of methodology, research population, unit of analysis, secondary data used and the measurement instrument were covered in detail. The data analysis approach was outlined thoroughly, including the preliminary analysis, structural equation models and the mediation analysis. The limitations of the methodology/design used were also discussed.

With a clear understanding of the methodology used, the results of the data analysis are now discussed, followed by the discussion of the results.

5. RESULTS

In this chapter, the results of the data analysis are presented. The results were obtained utilising the data analysis methodology set out in Chapter 4, to answer the research hypothesis set out in Chapter 3. Discussion of the results will follow in Chapter 6.

This chapter will follow the headings and structure as in the methodology Section 4.6 Data Analysis above, namely: Preliminary Analysis and then Structural Equation Modelling. All analysis was done at a 95% confidence interval.

5.1. PRELIMINARY ANALYSIS

5.1.1. Data Editing

The original sample size was 1324. Due to this large sample size outliers and missing data was deleted. Outliers were identified using Mahalanbois distance. Missing data points were also identified and with this editing of data, 117 responses were deleted, leaving the final sample size of 1204.

5.1.2. Normality Testing

The dataset was analysed for normality using the Skewness and Kurtosis in AMOS. All variables were measured, and Skewness values were between the thresholds of -2.58 and +2.58, and Kurtosis between -7 and +7. Therefore, all variables can be considered normally distributed. See Appendix Table 30 for full results.

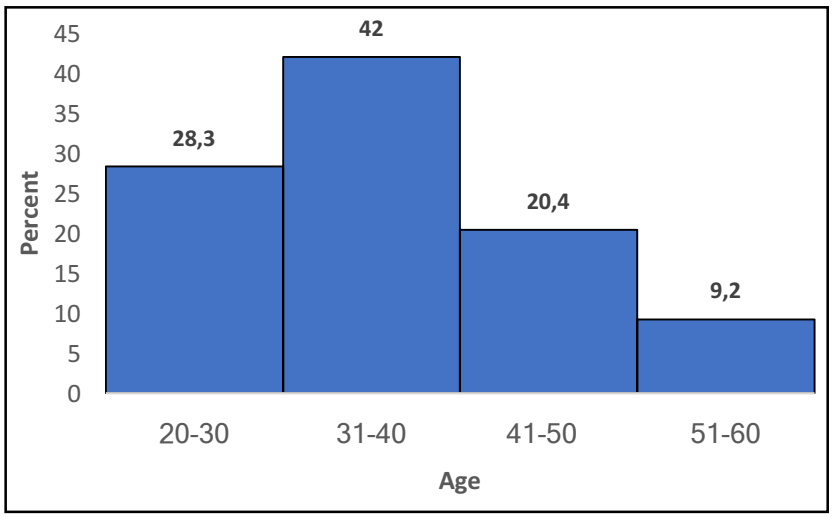
5.1.3. Descriptive Statistics

A range of descriptive statistics was done on the biographical information and control variables in the dataset. There was diversity of responses, and the most relevant of these are presented below. (The full set of descriptive statistics can be found in Table 31 the Appendix)

5.1.3.1. Biographical Data

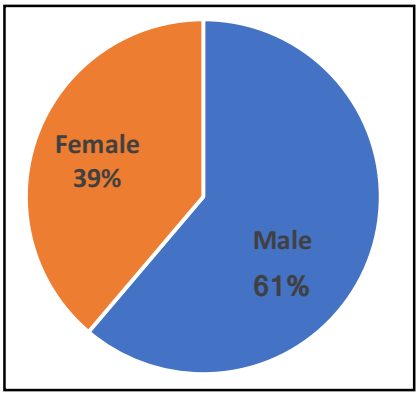
The age of respondents varied, with the majority at 42% from the 31 - 40 age group, as shown below in Figure 10.

Figure 10: Age of respondents (%)



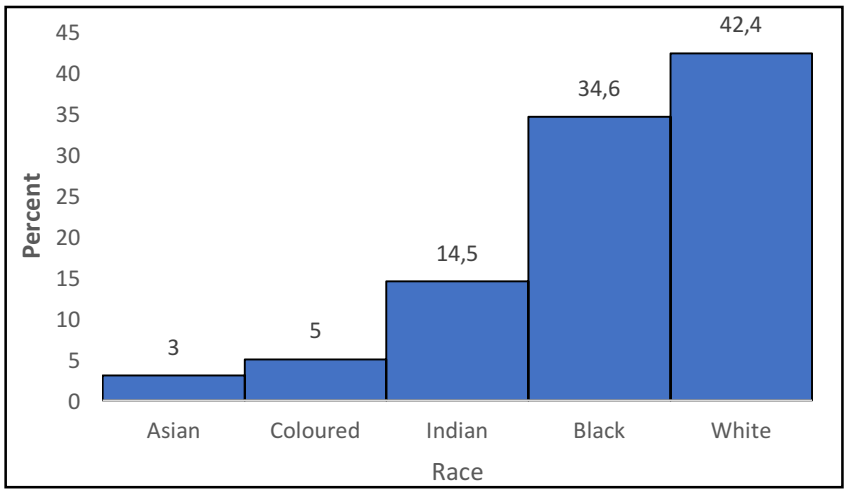
The gender was predominantly male at 61%, as shown in Figure 11:

Figure 11: Gender of respondents (%)



The race of respondents was dominated by Black and White, making up 77% of the s ple, as seen below in Figure 12:

Figure 12: Race of respondents



The rest of the biographical data did not show any trends that would add value to the research.

5.1.3.2. Control Variables

The respondents level of management in their organisation varied but was dominated by staff at 33.6% and middle managers at 36%. Table 7 below presents the level of management in the data set.

Table 7: Level of management

Level of Management	Frequency	Percentage
Staff	**404**	**33.6**
Supervisor	99	8.2
Middle manager	**434**	**36.0**
Senior manager	156	13.0
Executive	51	4.2
Others	60	5.0
Total	**1204**	**100.0**

The majority of respondents were from large organisations of more than 1000 employees (52.8%) that are more than ten years old (89.6%). This is shown in Table 8 and 9 below:

Table 8: Organisation size

Organisation Size	Frequency	Percentage
1-50 employees	66	5.5
51-100 employees	108	9.0
101-200 employees	74	6.1
201-500 employees	147	12.2
501-1000 employees	173	14.4
More than 1000 employees	**636**	**52.8**
Total	**1204**	**100.0**

Table 9: Age of organisation

Age of Organisation	Frequency	Percentage
less than a year	3	.2
1-3 years	17	1.4
4-5 years	41	3.4
6-10 years	64	5.3
More than10 years	**1079**	**89.6**
Total	**1204**	**100.0**

Lastly under the control variables was the organisation type: Bureaucratic or Entrepreneurial. There was an almost equal split between the two organisation types, as seen in Table 10 below.

Table 10: Organisation type

Organisation Type	Frequency	Percentage
Bureaucratic	579	48.1
Entrepreneurial	625	51.9
Total	**1204**	**100.0**

Other statistics of note is that majority of these respondents at 21.7% were involved in the operations side of the organisation.

5.1.4. Exploratory Factor Analysis

The three steps of suitability of data, factor extraction and factor rotation and interpretation, as described in Table 4 in the previous section, were followed to test the structure of the constructs

5.1.4.1. Suitability of Data

The Kaiser-Meyer-Olkin (KMO) and Bartlett's test of Sphericity are shown below in Table 11:

Table 11: KMO and Bartlett's test results

KMO and Bartlett's Test Results		
Kaiser-Meyer-Olkin Measure of Sampling Adequacy.		.968
Bartlett's Test of Sphericity	Approx. Chi-Square	37260.426
	df	741
	Sig.	.000

The data is, therefore, suitable for factor analysis as the KMO value is above 0.6, and Bartlett's test is significant. Given these results, the factor extraction step follows.

5.1.4.2. Factor Extraction

Principal Component Analysis methodology was used. First, the Kaisers criterion using the Eigenvalue and Total Variance explained was analysed, shown in Table 12 below:

Table 12: Initial Eigenvalues & variance

Initial Eigenvalues & Variance			
Component	Total	% of Variance	Cumulative %
1	15.959	40.920	40.920
2	5.416	13.887	54.807
3	1.433	3.673	58.480
4	1.327	3.402	61.882
5	1.010	2.590	64.472

The analysis showed five components with Eigenvalues above 1. Component number 1 has the highest Eigenvalue at 15.959 and explains 40,92% of the total variance. Using only the Eigenvalues, five components would be assessed as satisfactory, but using only this criteria can result in retaining too many factors (Hair et al., 2010; Pallant, 2011). Hence using the total variance explained, components that contribute more than 60% of the total variance are considered satisfactory. Therefore four components/factors will be used. This will be verified in the next step of factor rotation and interpretation.

5.1.4.3. Factor Rotation & Interpretation

Varimax orthogonal rotation was performed to extract components that maximise the variance explained, and to aid in the interpretation of these factors. The Varimax rotation output is shown in Table 32: Varimax Rotation in the Appendix.

The Varimax rotation supports the extraction of four components, and the items associated with components that have the highest loading values are highlighted. The analysis shows the following results of the four components:

- The first component, complexity leadership, includes 19 items from PA1 to CI17. These 19 items are strongly correlated to each other, and hence cannot be divided into sub-groups. Trying to separate them will cause discriminant validity issues.
- The second component, exploration, includes seven items from Xplo1 to Xplo7.
- The third component, exploitation, also includes seven items from Xploi11 to Xploi7.
- The fourth component, organisational innovation climate, includes six items from OIC1 to OIC6.

Therefore, the Varimax rotation supports the use of four components and shows no factors loading to component five. There are some cross-loadings of exploration, exploitation and organisational innovation climate. These cross loading are however of a lower value than its primary loading, and will be explored in the discussion chapter, and analysed in the validity section below.

The findings from the Exploratory Factor Analysis thus support the use of four components, which is consistent with the research measurements scales used in the questionnaire. Of importance is that this analysis confirmed that the measurement scales used for complexity leadership and organisational innovation climate, which are new scales, load onto the appropriate construct. With the preliminary analysis done, the SEM analysis follows.

5.2. STRUCTURAL EQUATION MODELLING

SEM was performed according to the steps in Table 1. These steps are the measurement model, structural model and mediation analysis.

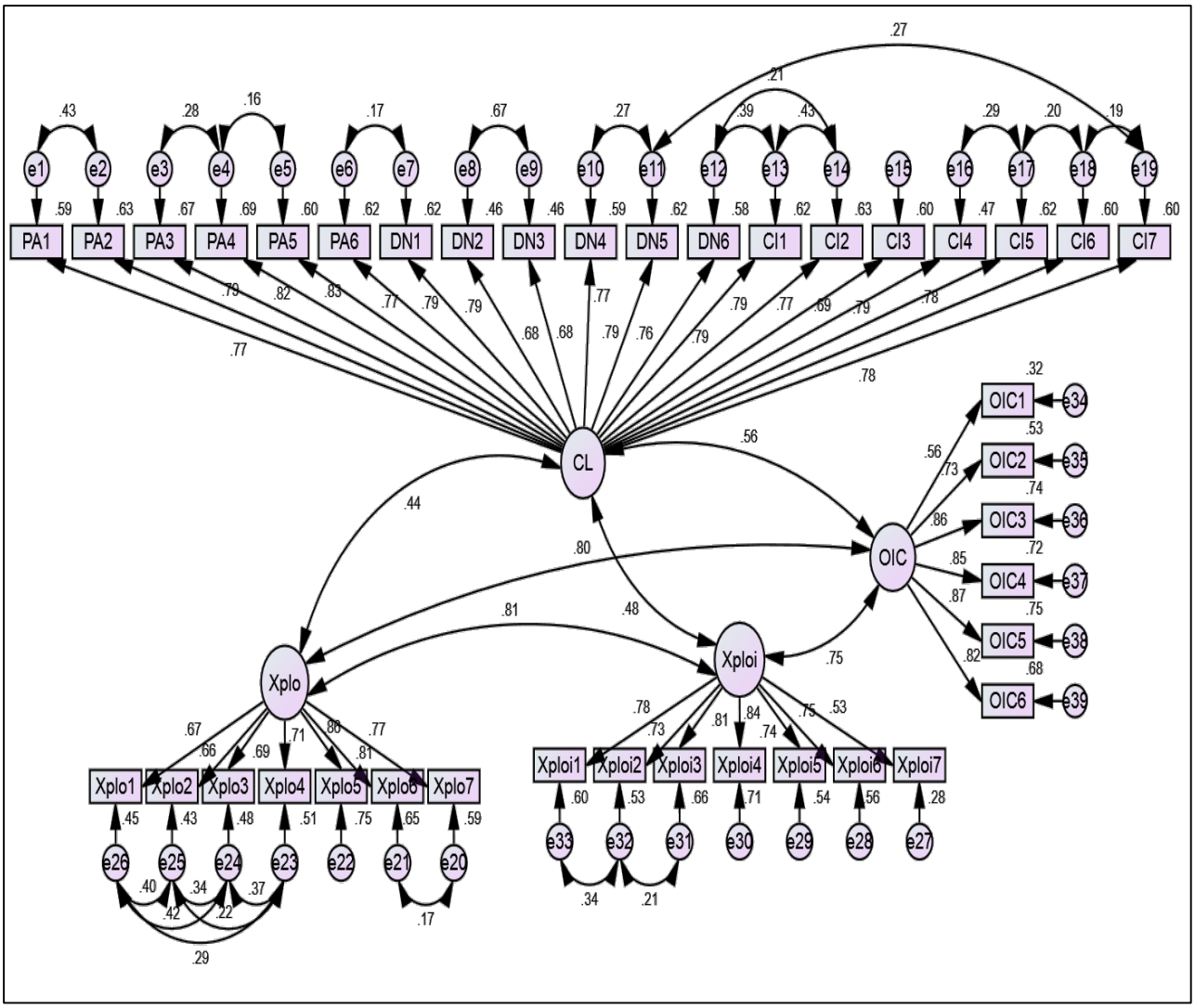
5.2.1. Measurement Model

The SEM approach was used to develop the confirmatory factor analysis (CFA), also called the measurement model. The steps described in Table 6: SEM measurement model steps were followed.

5.2.1.1. Confirmatory Factor Analysis

CFA was performed using the SEM analysis function of IBM Amos.24 software. The results from the EFA in the preliminary analysis were used, to confirm the factors that were analysed in the structural model. The measurement model output is shown below in Figure 13.

Figure 13: CFA - measurement model

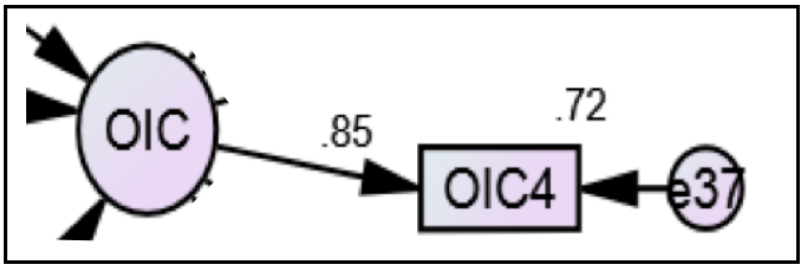


The CFA supported the EFA findings, and showed that the items (sub-constructs) are associated with each of the constructs. The validity and reliability of these findings will be dealt with below in the appropriate section. The model shows two coefficients, the factor loading and correlation estimates.

Factor Loading

The measurement contribution of each item in the construct is indicated by its factor loading, designated by an arrow from the construct to the observed variable. This is shown in an example below, in Figure 14:

Figure 14: Factor loading example



In the example, OIC4 has a factor loading of 0.85 onto OIC, which means it measures OIC at 85%. Since there is always a margin of error when measuring abstract constructs, an error term is associated with each item. As an example, the item OIC4 has an error term e37 and an error coefficient of 0.72. These error terms indicate the variance explained of each item by its construct.

Table 33 in the Appendix shows the measurement model factor loadings of each observed variable onto its construct and their significance. All factor loadings in the model are acceptable with a value above 0.5, with the majority being ideal and above 0.7 (Hair et al., 2010). All the factor loadings are also significant at a 95% confidence interval. The researcher can, therefore, conclude that the measures used are acceptable.

Correlation Estimates

The double-headed arrows in the model indicate the bivariate correlation coefficients between constructs and the error terms. As an example, shown in Figure 15 below, the correlation coefficient between Xploi and OIC is 0.75, meaning that when one of these variables increase by one standard deviation, the other variable also increases by 75% of its standard deviation.

Figure 15: Correlation estimate example

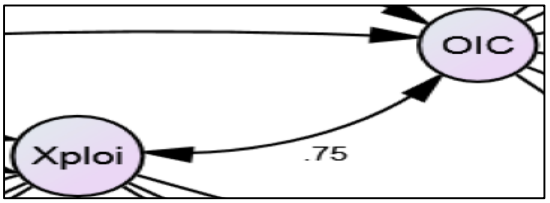


Table 34 in Appendix A shows the measurement model correlation estimates and their significance. Most of the correlation estimates are below 0.7 and can be considered acceptable. All estimates are significant at a 95% confidence interval. There are however correlation estimates that are above 0.7 between the model constructs as shown in the measurement model and Table 13 below:

Table 13: Selected correlation estimates

Constructs			Estimate	P value
Xploi	←→	OIC	**.751**	0.0001
Xplo	←→	OIC	**.797**	0.0001
Xplo	←→	Xploi	**.815**	0.0001

The above correlation estimates are above the known threshold of 0.7 and are significant. This indicates a possible discriminant validity concern. This was investigated further in the section to follow and explained in the discussion chapter concerning the researcher's insights and current theory

Overall the researcher can conclude that the measurement model confirmed the scales used load onto the relevant constructs. The validity and reliability of these scales then follow.

5.2.1.2. Validity

The AVE and MSV were calculated for the constructs; these are shown in Table 14 below:

Table 14: Validity analysis

Scale	Convergent Validity:	Discriminant validity
	AVE	MSV
Complexity leadership	0.595	0.316
Organisation innovation climate	0.624	0.635
Exploitation	0.555	0.664
Exploration	0.552	0.664

The Convergent Validity for all constructs is satisfactory with values of AVE above 0.5. Complexity leadership has no Discriminant validity concern as the MSV coefficient is less than the AVE coefficient. However, there are discriminant validity concerns with the constructs organisational innovation climate, exploitation and exploration as the MSV coefficient is greater than the AVE coefficient for each construct. This indicated that these constructs are strongly correlated with other constructs, and may have cross loading of items. Therefore, a correlation and square root of AVEs matrix were performed for further analysis, shown in Table 15 below.

Table 15: Validity - Correlation and square root of AVEs matrix

Correlation and Square root of AVEs				
Scale	**Complexity leadership (CL)**	**Organisation Innovation climate (OIC)**	**Exploitation (Xploi)**	**Exploration (Xplo)**
Complexity leadership (CL)	0.771			
Organisational innovation climate (OIC)	0.562	0.790		
Exploitation (Xploi)	0.481	0.751	0.745	
Exploration (Xplo)	0.444	0.797	0.815	0.743

The discriminant validity concerns are more pronounced for the constructs of exploitation and exploration, with the highest correlation of 0.815, which is greater than the Square root of AVEs (shown in blue) of these constructs. This correlation was expected by the researcher and is not considered problematic. This is because exploitation and exploration as constructs belong to the higher-level construct of contextual ambidexterity, but were analysed independently, as described above, to add depth to the results and discussion. This finding is also supported theoretically by Gibson and Birkinshaw (2004), that described contextual ambidexterity as a construct that is multidimensional, comprised of the combination of exploitation and exploration. This will be elaborated further in the discussion chapter.

Table 14 also shows discriminant validity concerns between the constructs of organisational innovation climate and exploitation and exploration. The magnitude of this correlation is not considered problematic as the differences between the correlation coefficient, and the squared root of AVEs is small (less than 0.1):

- OIC and Xplo have a correlation coefficient of 0.797. The square root of AVEs for OIC is 0.790 and for Xplo is 0.743. Therefore, the difference between the correlation coefficient and the respective square root of AVEs is less than 0.1, meaning the discriminant validity concerns found are not alarming.
- The same is true for the concern between Xploi and OIC. The correlation coefficient is 0.751. OIC square root of AVE at 0.791 is greater than 0.751, whereas Xploi is less than at 0.745. This raises a concern of discriminant validity of Xploi and OIC, but again the difference between the coefficient of correlation and square root of AVE in the relationship is less than 0.1, meaning the discriminant validity concerns found are not alarming.

For further analysis, the researcher looked at the inter-item correlation table of the constructs to better understand these relationships and concerns. The inter-item correlations, shown in Table 35 in the Appendix, between OIC, Xplo and Xploi are all below 0.7 and are moderate with values between 0.3 to 0.6. This confirms that the discriminant validity concern of OIC is not alarming. The researcher suspects that it is the widespread of these moderate correlations among the items that are the cause of the validity concern. Additionally, this relationship was

expected by the researcher, as literature shows that an organisation innovation climate is an antecedent for contextual ambidexterity, and would logically lead to increased innovation in an organisation (Cerne et al., 2013; Charbonnier-Voirin et al., 2010; Gibson & Birkinshaw, 2004; Jaiswal & Dhar, 2015; Sarros et al., 2008; B. Schneider et al., 2016; Wang et al., 2013).

Therefore, through the analysis, convergent validity was satisfactory. Discriminant validity concerns were highlighted, but the researcher showed through further analysis and theoretical insights that they are of no major concern. Thus, the analysis can continue with the reliability statistics.

5.2.1.3. Reliability

Cronbach's Alpha and the Composite Reliability Coefficient was done. Results are shown in Table 16 below:

Table 16: Reliability - Cronbach's Alpha & Composite Reliability Coefficient

Scale	Cronbach's Alpha	Composite Reliability coefficient
Complexity leadership	0.962	0.965
Organisation innovation climate	0.894	0.907
Exploitation	0.880	0.896
Exploration	0.902	0.895

Cronbach's Alpha is greater than 0.8 for all scales, indicating very good reliability. The Composite Reliability Coefficients for all scales is above 0.7, which confirms good reliability. The researcher can, therefore, conclude that the scales are reliable and that all questions in the survey contributed to the measurements and thus none were removed. These results also confirm those done by the creators of the survey questions, as described above in section 4.5.5.3 and in shown in Table 28 and 29 in Appendix A.

With validity and reliability analysis completed, the model fit for the measurement model was performed.

5.2.1.4. Model Fit Analysis

The Chi-square of the measurement model was 2212.659, degrees of freedom 674 and a p-value of 0.000. However the Chi-square is overly sensitive to models that have large sample sizes (Credé & Harms, 2015). Therefore, additional model indices were done by the researcher, as shown in Table 17 below:

Table 17: Measurement model fit indices

Fit indices	Calculated Value	Interpretation
CMIN/Df	3.283	Acceptable
GFI	.908	Good
CFI	.959	Good
TLI	.955	Good
RMSEA	.044	Good

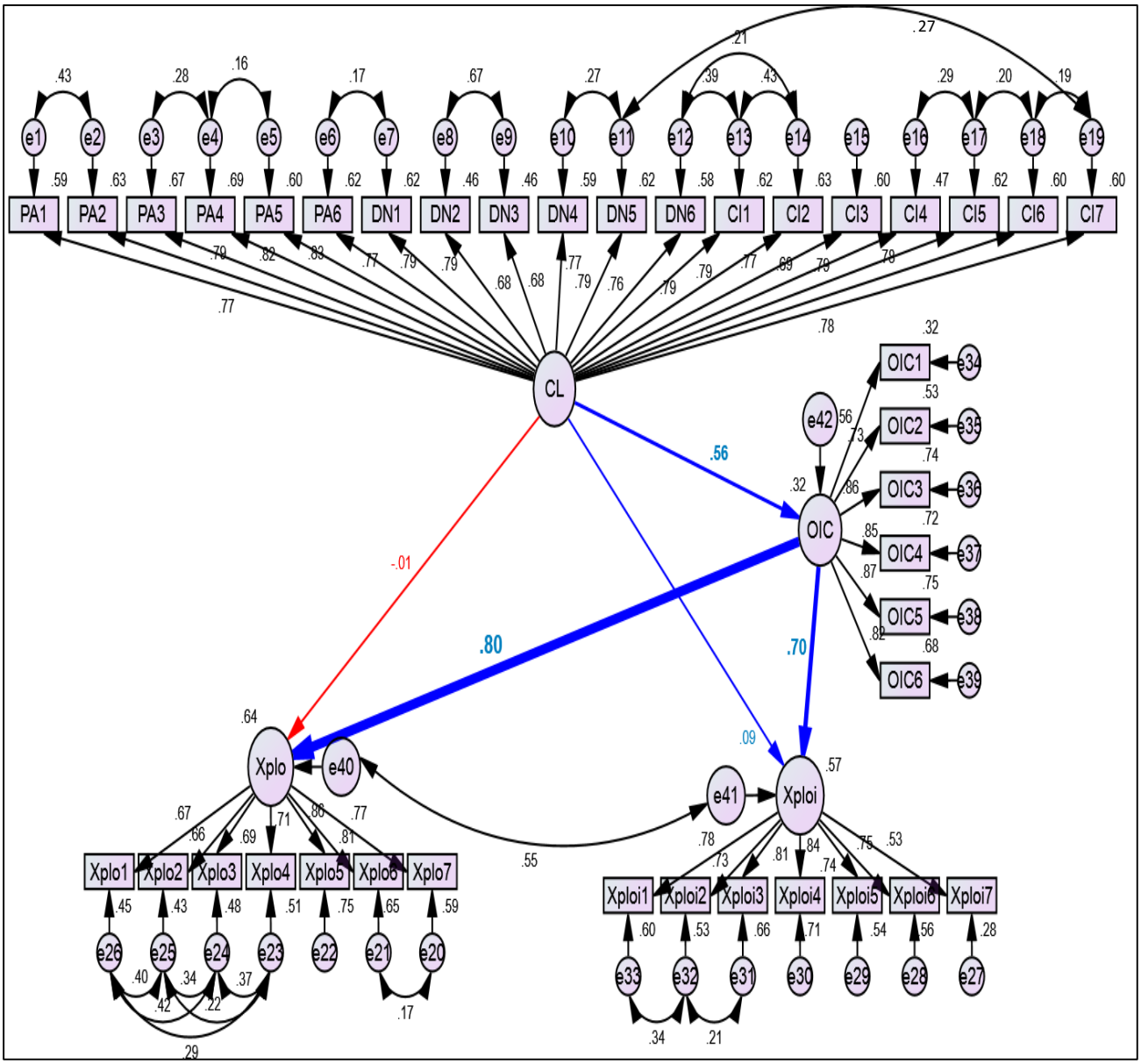
As the table shows, the measurement model fits the data as all indices are within the required thresholds.

The researcher can thus conclude that the measurement model steps provided satisfactory results: CFA produced some concerns that were dealt with in the validity analysis, reliability was proven, and model fit accepted. As such, the measurement model was accepted, and the structural model follows.

5.2.2. Structural Model

The structural model was developed and tested with maximum likelihood in AMOS 24, and is shown in Figure 16 below:

Figure 16: Structural model



The structural model shows correlation coefficients (as did the measurement model), but also illustrates the structural dependence relationships (path estimates or regression coefficients) between the variables. These elements will be explained below.

First, the structural model fit was analysed

5.2.2.1. Model Fit Analysis

The Chi-square of the structural model was 2212.659, degrees of freedom 674 and a p-value of 0.000. The model fit analysis is shown below in Table 18.

Table 18: Structural model fit indices

Fit indices	Calculated Value	Interpretation
CMIN/Df	3.283	Acceptable
GFI	.908	Good
CFI	.959	Good
TLI	.955	Good
RMSEA	.044	Good

From the fit indices, the researcher concluded that the structural model fits the data satisfactorily, and therefore the structural model can be used for hypothesis analysis.

5.2.2.2. Correlation Estimates

Table 36 in the Appendix lists the correlations estimates of the structural model. The table shows that all the correlations estimates are below 0.7, and significant. Therefore, the correlations are satisfactory and not alarming.

5.2.2.3. Regression Weights, Hypothesis & Variance Explained

The regression weights illustrated using straight arrows to depict the direction of the relationship, with blue arrows signifying significant relationships and red arrows non-significant relationships. The breadth of the arrow signifies the strength of said relationships. The variance explained by each relationship is also shown in the model. An example of these elements from the model illustration, for clarity, is shown in Figure 17 below:

Figure 17: Structural model elements

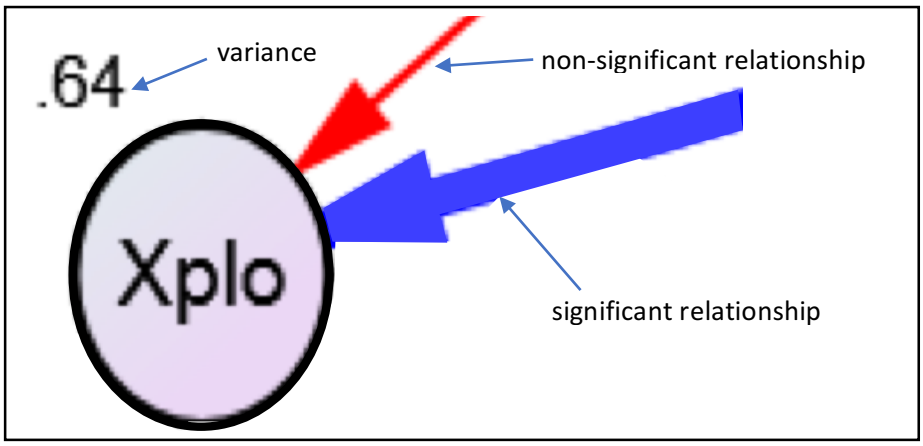


Table 19 below lists the regression coefficient estimates and significance of the structural relationships of the model.

Table 19: Structural model - regression coefficients & significance

Hypothesis	Dependent variable		Independent variable	Regression coefficient estimate	p-value
H1	Organisational innovation climate	←	Complexity leadership	.562	.000
H2a	Exploitation	←	Complexity leadership	.085	.003
H2b	Exploration	←	Complexity leadership	-.006	.829
H3a	Exploitation	←	Organisational innovation climate	.704	.000
H3b	Exploration	←	Organisational innovation climate	.801	.000

Therefore, there is only one non-significant relationship in the model between complexity leadership and exploration, as the p-value is .829, which is greater than .05. All other relationships are significant at a 95% confidence interval with p-values less than .05.

From Table 19 above, the researcher can draw conclusions from the SEM analysis. These are listed below, in Table 20, as set out by the research objectives and hypotheses.

Table 20: Hypothesis conclusions

Hypothesis	Dependent variable		Independent variable	Hypothesis Conclusion
Objective 1: Confirm that there is a positive relationship between complexity leadership and organisational innovation climate.				
H1	Organisational innovation climate	←	Complexity leadership	• **Complexity leadership** has a positive and significant effect on **organisational innovation climate**. • When **complexity leadership** increases by 1 standard deviation, **organisational innovation climate** also goes up by 0.562 of its standard deviation
				• Therefore the null hypothesis is rejected, and the alternate hypothesis supported
Objective 2: Confirm that there is a positive relationship between complexity leadership and contextual ambidexterity				
H2a	Exploitation	←	Complexity leadership	• **Complexity leadership** has a weak but significant effect on **exploitation**. • When **complexity leadership** goes up by 1 standard deviation, **exploitation** also goes up by 0.085 of its standard deviation.
				• Therefore the null hypothesis is rejected, and the alternate hypothesis supported
H2b	Exploration	←	Complexity leadership	• There is no significant relationship between **complexity leadership** and **exploration** • Therefore, **complexity leadership** has no significant direct impact on **exploration**.
				• Therefore the we fail to reject the null hypothesis.

Objective 3: Confirm that there is a positive relationship between organisational innovation climate and contextual ambidexterity				
H3a	Exploitation	←	Organisational innovation climate	• **Organisational innovation climate** has a positive and significant effect on **exploitation.** • When **organisational innovation climate** goes up by 1 standard deviation, **exploitation** also goes up by 0.704 of its standard deviation.
				• Therefore the null hypothesis is rejected, and the alternate hypothesis supported
H3b	Exploration	←	Organisational innovation climate	• **Organisational innovation climate** has a positive and significant effect on **exploration.** • When **organisational innovation climate** goes up by 1 standard deviation, **exploration** also goes up by 0.801 of its standard deviation.
				• Therefore the null hypothesis is rejected, and the alternate hypothesis supported

As shown above, the structural model analysis includes the variance explained for the structural dependent relationship. From the significant relationships, the researcher can use the variance explained to add further insight into these relationships. This variance explained is not causal, but can be used to predict the effect that variance in the Independent variable (in this case called the predictor) can have on the dependent variable (Hill & Lewicki, 2006; Kline, 2011). Put simply, as complexity leadership is correlated with organisational innovation climate, complexity leadership can be said to "explain" or "predict" the variance in organisational innovation climate, even though complexity leadership does not directly cause organisational innovation climate. This analysis is shown in Table 21 below.

Table 21: Structural model - variance explained

Dependent Variable		Predictor	Variance Explained	Conclusion
Organisational innovation climate	←	Complexity leadership	32%	• **Complexity leadership** is a strong predictor of **organisational innovation climate**. • An improvement of **complexity leadership** can positively affect **organisational innovation climate** up to 32%.
Exploration	←	Organisational innovation climate	64%	• **Organisational innovation climate** significantly predicts **exploration**. • **Organisation innovation climate** can positively affect **exploration** by 64%.
Exploitation	←	Organisational innovation climate	57%	• **Organisational innovation climate** and **complexity leadership** are both significant predictors of **exploitation**. • **Organisational innovation climate** is the stronger predictor with a higher regression coefficient of 0.704. • **Both predictors** have can positively affect **exploitation** by 57%
		Complexity leadership		

Following on, the last objective of the research results is the mediation analysis

5.2.3. Mediation Analysis

In this section, the researcher evaluated the effect of complexity leadership on exploitation and exploration via the proposed mediator of organisational innovation climate. Mediation analysis was carried out using Amos 24: Bootstrapping (2000 resamples) enabled the computation of the estimates of the indirect effect at 95% biased-corrected *p*-values. Results of the mediation analysis are shown in Table 22 below.

Table 22: Mediation analysis

Objective 4: Determine if organisational innovation climate has a mediating effect on the relationship between complexity leadership and exploitation/exploration								
Hypothesis	**Dependent variables (DV)**	**Direct Effect of complexity leadership on the DV**		**Indirect Effect of complexity leadership on the DV**		**Total Effect of complexity leadership on the DV**		**Hypothesis Conclusion**
		Coefficient	***p***	**Coefficient**	***p***	**Coefficient**	***p***	
H4a	Exploitation	.085	.025	.396	.001	.481	.002	Partial mediation
	Therefore the null hypothesis is rejected, and the alternate hypothesis supported							
H4b	Exploration	-.006	.812	.450	.001	.444	.001	Total mediation
	Therefore the null hypothesis is rejected, and the alternate hypothesis supported							

The mediation analysis shows the following results:

- Organisational innovation climate partially mediates the effect of complexity leadership on exploitation. The direct effect of complexity leadership on exploitation is significant and positive (*p*-value .025 and coefficient .085). However, the indirect effect of complexity leadership on exploitation via the mediator remains significant (*p*-value .001) with an increased positive effect (coefficient .396). This, therefore, indicates partial mediation.
- Organisational innovation climate totally mediates the effect of complexity leadership on exploration. The direct effect of complexity leadership on exploration is not significant (*p*-value .812). The indirect effect of complexity leadership on exploration via the mediator is however significant (*p*-value .001) and positive (coefficient .450). Therefore, the criteria of total mediation are met.
- The total effect of complexity leadership on exploitation and exploration is also shown. This is the addition of the direct and indirect effects. These relationships are significant with a *p*-value of less than 0.05.

5.3. CHAPTER CONCLUSION

This section presented the full data analysis results as set out by the data analysis methodology, and guided by the research objectives and hypotheses. With the results

presented and hypotheses conclusions stated by the researcher, the discussion of these results follows under the headings of the four research objectives.

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6. DISCUSSION

This chapter discusses the results obtained by the researcher as set out in Chapter 5. The chapter is structured around the four research objectives and compares findings to the review of the relevant literature in Chapter 2. The final chapter of recommendations and conclusions follows.

Certain results are common to the analysis done and all the constructs, and can, therefore, be stated upfront to prevent repetition and provide clarity:

- The EFA results showed that data were suitable for factor extraction and that four components were extracted (see Table 11, 12 and 32). This supported the researchers theoretical and conceptual model and allowed for CFA to follow.
- CFA results from the SEM Measurement model confirmed the EFA findings of the four constructs that the appropriate items from the measurement scales loaded to the constructs. Therefore, the measurement scales used are measuring what is intended to be measured.
- All CFA factor loading estimates from the SEM Measurement were significant and acceptable (see Table 33). Therefore, the items measure the constructs at an acceptable level and are significant, and can, therefore, be used in the analysis.
- All scales used were reliable with good reliability as measured by Cronbach's Alpha and Composite Reliability Coefficients (see Table 16). Therefore, questions in the survey contributed to the measurements.
- Both the SEM Measurement model and Structural model have acceptable to good model fit indices (see Table 17 and 18). Therefore, both models fit the data satisfactorily, and the Structural model used for hypothesis analysis.

Other CFA results are discussed under each objective where it adds to the discussion, and where concerns will be explained according to the relevant literature. As the constructs are repeated in relationships, only the relevant CFA results will be discussed under that research objective. The specific validity concerns of organisational innovation climate, exploration and exploitation will be discussed in Objective 3 where the relationships between these constructs are analysed and interpreted. The focus, however, will be on the SEM structural model and the relationships set out in the research objectives and hypothesis.

6.1. DESCRIPTIVES & CONTEXT

The researcher looked at descriptive statistics so that the context of the results obtained could be understood, and added to the discussion. The descriptive statistics show some interesting results that help to explain the results obtained in the SEM analysis and the research objectives.

If the researcher had to profile the typical respondent of the questionnaire from the results in section 5.1.3 above, the following would be seen: a white male, aged between 20 and 40, at staff or management level, in large organisations of more than 1000 employees that are more than ten years old. This adds context to the SEM analysis and hypotheses. The respondents are at an appropriate level to rate their leader in the skills needed for complexity leadership as if there were too many senior managers or executives there might not have been many peers to rate, or they would have rated themselves and possibly skewed the results in their favour.

Looking at the age and size of organisation add interesting context to the analysis. The researcher suspects that this may influence the complexity leadership and innovation constructs. Older organisations turn to traditional type leadership and hierarchical approaches, and thus exploration is lacking, and exploitation is the comfortable choice (Uhl-bien & Arena, 2017). Therefore, these older organisations will have more traditional type leaders (Uhl-bien & Arena, 2017) and as complexity leadership is a new leadership theory respondents may not have had adequate exposure to its intricacies. Thus respondents will most likely have been exposed to exploitative approaches (Mendes et al., 2016).

6.2. OBJECTIVE 1: Complexity Leadership & Organisational Innovation Climate

Objective 1: Confirm that there is a positive relationship between complexity leadership and organisational innovation climate. Therefore, complexity leadership leads to an organisational innovation climate.

6.2.1. Results from data analysis

CFA Results

The CFA of complexity leadership and organisational innovation climate showed no concerns of correlation and the validity analysis was satisfactory. Therefore, CFA was satisfactory, and the constructs could be analysed in the SEM structural model.

Structural model Results

A summary of the results from the SEM analysis are in Table 23 below:

Table 23: Objective 1 - Hypothesis 1 conclusion: SEM analysis

Objective 1	Conclusion: Regression coefficient & Variance
Hypothesis 1: accept the alternate - H_11	• A significant positive linear relationship exists between complexity leadership and organisational innovation climate. • Complexity leadership accounts for 32% of the variance in organisational innovation climate. • If complexity leadership increases by one standard deviation, organisational innovation climate increases by 0.562 of its standard deviation

6.2.2. Comparison to existing literature

This research supports and builds on Jaiswal & Dhar (2015) and B. Schneider et al. (2016). Jaiswal & Dhar (2015) showed that transformational leadership is an antecedent of climate in organisations that provide support for innovation, and thus this research shows that complexity leadership is also an antecedent for an organisational innovation climate. B. Schneider et al. (2016) also supported this finding, stating leadership plays a significant role in organisational climate. One of the objectives if this research, as stated in the research problem, was to add to leadership literature, and specifically complexity leadership as called for by Mendes et al. (2016), Avolio, Walumbwa, & Weber (2009) and M. Schneider & Somers (2006). This objective has been fulfilled and adds to the theoretical teachings of complexity leadership.

Organisational innovation climate was defined by the researcher as: a set of shared employee perceptions about the organisations context and workgroup environment to provide sufficient resources that encourages, supports, rewards and enables risk-taking, creativity, learning and initiative (Charbonnier-Voirin et al., 2010; Jaiswal & Dhar, 2015; Sarros et al., 2008; Wang et al., 2013). The researcher conceptualised that complexity leadership would create this organisational innovation climate through enabling leadership, which is described by Uhl-Bien (2016) as an adaptive space. This adaptive space is described as conditions as well as the contexts that enable innovation (Uhl-bien & Arena, 2017). Therefore, this conceptualisation was proven theoretically by the analysis done. This adaptive space will also be explored under contextual ambidexterity below, as it occurs at the interface between exploitation and exploration (Arena & Uhl-Bien, 2016).

Numerous other scholars also support the theory that leadership plays a vital role to create the context of an innovation climate (Cerne et al., 2013; Damanpour & Schneider, 2006; Gibson & Birkinshaw, 2004; Uhl-bien & Arena, 2017), and that complexity leadership must recognise what climate will support the innovative process (Uhl-Bien et al., 2007). This research supports these findings and shows the role that complexity leadership has in the theory. Thus complexity leadership can be added to the leadership styles that create a climate that can foster creativity (Jaiswal & Dhar, 2015; B. Schneider et al., 2016)

From the data analysis and the support of current theory, the researcher can conclude that complexity leadership has a strong positive linear relationship with organisational innovation climate and that an increase in complexity leadership will lead to an increase in organisational innovation climate. Complexity leadership is also a significant predictor of organisational innovation climate and explains 32% of its variance. Objective 1 of this research has therefore been met satisfactorily.

6.3. OBJECTIVE 2: Complexity Leadership & Contextual Ambidexterity

Objective 2: Confirm that there is a positive relationship between complexity leadership and contextual ambidexterity (exploitation and exploration). Therefore, complexity leadership leads to exploitation and exploration.

6.3.1. Results from data analysis

CFA Results

The CFA of complexity leadership and exploitation and exploration showed no concerns of correlation, and the validity analysis was satisfactory. Therefore, CFA was satisfactory, and the constructs could be analysed in the SEM structural model.

Structural model Results

A summary of the results from the SEM analysis are detailed in Table 24 below:

Table 24: Objective 2 - Hypothesis 2a & 2b conclusion: SEM analysis

Objective 2	Conclusion: Regression coefficient & Variance
Hypothesis 2a: accept the Alternate - $H_1$2a	• A significant positive linear relationship exists between complexity leadership and exploitation. • Complexity leadership and organisational innovation climate account for 57% of the variance in exploitation. • If complexity leadership increases by one standard deviation, exploitation increases by 0.085 of its standard deviation
Hypothesis 2b: Fail to reject the Null - $H_0$2b	• No significant relationship exists between complexity leadership and exploration.

6.3.2. Comparison to existing literature

As mentioned in section 4.5.5.1 above, exploitation and exploration were analysed separately to add insights and discussion points, but are conceptualised as occurring concurrently in an organisation as contextual ambidexterity.

The findings above partly support that of Gibson & Birkinshaw (2004), and Raisch & Birkinshaw (2008) in that leaders play a crucial role in developing organisational ambidexterity, but that only exploitation was directly supported by complexity leadership. As there has been limited research on how leaders can promote ambidexterity (O'Reilly & Tushman, 2013), this study finds that complexity leadership promotes exploitation, but not exploration.

There have been studies indicating that transformational leadership behaviours promote ambidexterity (Baškarada et al., 2016). Jansen et al. (2009) and Baškarada et al. (2016) showed that transformational leadership might be more appropriate for exploratory innovation, and transactional leadership for exploitative innovation. Therefore Jansen et al. (2009) argued that both types of leadership are required to promote innovation strategically.

Complexity leadership aims to address this as Complexity Leadership Theory is a framework that seeks to "integrate complexity dynamics and bureaucracy… exploration and exploitation" (Uhl-Bien et al., 2007, p. 304). The theory uses three types of leadership to enable this. Firstly, Operational leadership to align systems and processes, thus exploitation. Secondly, Entrepreneurial leadership to create new ideas and solutions, thus exploration. Also, lastly Enabling leadership to interact in the adaptive space (as described above).
Therefore, the findings of this study are surprising to the researcher and do not fully support Complexity Leadership Theory that complexity leadership would promote exploitation and exploration, as only exploitation was supported. Even more interesting is that contextual intelligence, which is an attribute of complexity leadership (Kutz & Bamford-Wade, 2013) showed strong loading factors, and should promote emergence of new ideas and exploration innovation (Uhl-bien & Arena, 2017). The researcher suspects that this finding may be related to the context and profile of the population that responded to the questionnaire. Although the split was almost even between bureaucratic and entrepreneurial type organisations, the majority of respondents (89.6%) were from organisations that were ten years or older. Uhl-Bien and Arena (2017) showed that older organisations turn to traditional type leadership and hierarchical approaches to complexity and change, and thus exploration is lacking and exploitation is the comfortable choice. Therefore, these older organisations will have more traditional type leaders (Uhl-bien & Arena, 2017) and respondents will most likely have seen exploitative approaches, hence exploitation supported and exploration not (Mendes et al., 2016).

Additionally, the analysis approach used by the researcher may have resulted in the findings. SEM is a multivariate technique that enables the analysis of multiple relationships between constructs, the complexity of perceptions, and keeps the context in focus (Babin & Svensson, 2012). Therefore, with the organisational innovation climate construct in the SEM analysis, which has significant relationships with exploration and exploitation (which will be explored in Objective 3's discussion), the SEM structural model shows how complexity leadership has an indirect effect on exploration and exploitation through the organisational innovation climate. Therefore, leaders must create the context if they want to enable exploration (this will be explored in sections below). It is the goal of complexity leadership to recognise what climate will generate creative ideas and drive adaptability, learning and the innovative process (Uhl-Bien et al., 2007).

Of note is that although the relationship between complexity leadership and exploitation was significant, but was weak. When complexity leadership increases by one standard deviation, exploitation also goes up by 0.085 of its standard deviation. The variance explained in exploitation is through complexity leadership and organisational innovation climate, and as complexity leadership has a much lower regression coefficient in the relationship with

exploitation compared to organisational innovation climate (0.085 and 0.704 respectively), it is a weak predictor of exploitation.

Therefore, this study partly supports some literature, but has findings that do not support that complexity leadership promotes contextual ambidexterity, namely continuous exploitation and exploration. Complexity leadership was found to have a weak positive but significant relationship with exploitation. The variance explained in exploitation is influenced by two variables in the relationship: complexity leadership and organisational innovation climate. Complexity leadership has no significant relationship with exploration, except through mediation which is discussed next. Objective 2 of this research has therefore been met satisfactorily.

6.4. OBJECTIVE 3: Organisational Innovation Climate & Contextual Ambidexterity

Objective 3: Confirm that there is a positive relationship between organisational innovation climate and contextual ambidexterity (exploitation and exploration). Therefore, organisational innovation climate leads to exploitation and exploration.

6.4.1. Results from data analysis

CFA Results

The CFA of organisational innovation climate and exploitation and exploration showed some concerns of correlation, shown in Table 13 above. From these results the researcher expected validity concerns in the analysis, and these are shown in Table 14 and 15 above. Validity analysis for organisational innovation climate and exploitation and exploration had some discriminate validity concerns. The theoretical insights of the researcher with regards to these findings adds to the discussion, and now follows.

Looking first at exploitation and exploration: The high correlation between these constructs was expected by the researcher. These constructs were assessed using existing multi-item scales, designed and tested to assess contextual ambidexterity, which is the higher-level construct of the combination of exploitation and exploration, from the work of Jansen, Bosch and Volberda (2006). Gibson and Birkinshaw (2004) defined contextual ambidexterity as “the behavioral capacity to simultaneously demonstrate alignment and adaptability across an entire business unit" (p.209) and that it is multidimensional composing of the combination of exploitation and exploration. Therefore exploitation and exploration are linked and even intertwined, and organisations need to engage in both to ensure future viability (Floyd & Lane, 2000; Levinthal & March, 1993). As mentioned above and in section 4.5.5.1 authors have shown that ambidexterity can be measured by the multiplicative interactions between exploration and exploitation (De Clercq et al., 2014; Nemanich & Vera, 2009). Therefore, exploration and exploitation are two separate factors, which when combined measure contextual ambidexterity. The researcher followed this method, and analysed exploration and

exploitation as two variables in the structural equation model, to represent contextual ambidexterity. The researcher also felt that this would add to the results and discussion, to investigate the relationships that organisational innovation climate has on exploitation and exploration, and the SEM analysis method used allows for and supports this. Therefore, the findings of this research support current literature and show that exploitation and exploration are linked, hence the correlational and validity results.

Secondly looking at organisational innovation climate and the constructs correlations with exploitation and exploration: These constructs had high correlations coefficients and discriminant validity concerns. These correlations were expected by the researcher, as the literature supports that organisational innovation climate would logically lead to increased innovation (Jaiswal & Dhar, 2015), this will be explored further in the hypothesis discussion below. The researcher also looked at the inter-item correlation table, as explained in the results above, which showed a wide spread of moderate correlations, and explained the validity results. Additionally, the discriminant validity results were found to not be alarming, as explained in section 5.2.1.2 above and supported theoretically by the literature (Cerne et al., 2013; Charbonnier-Voirin et al., 2010; Gibson & Birkinshaw, 2004; Jaiswal & Dhar, 2015; Sarros et al., 2008; B. Schneider et al., 2016; Wang et al., 2013).
Therefore, CFA was satisfactory and concerns dealt with, and the constructs could be analysed in the SEM structural model.

Structural model Results

A summary of the results from the SEM analysis are in Table 25 below:

Table 25: Objective 3 - Hypothesis 3a & 3b conclusion: SEM analysis

Objective 3	Conclusion: Regression coefficient & Variance
Hypothesis 3a: accept the Alternate - $H_1$3a	• A significant positive linear relationship exists between organisational innovation climate and exploitation. • Organisational innovation climate and complexity leadership account for 57% of the variance in exploitation. • If organisational innovation climate increases by one standard deviation, exploitation increases by 0.704 of its standard deviation
Hypothesis 3b: accept the Alternate - $H_1$3b	• A significant positive linear relationship exists between organisational innovation climate and exploration. • Organisational innovation climate accounts for 64% of the variance in exploration. • If organisational innovation climate increases by one standard deviation, exploration increases by 0.801 of its standard deviation

6.4.2. Comparison to existing literature

The findings above support numerous scholars, and confirms that organisational innovation climate is an antecedent for innovation and ambidexterity (Cerne et al., 2013; Charbonnier-Voirin et al., 2010; Jaiswal & Dhar, 2015; Sarros et al., 2008; B. Schneider et al., 2016; Wang

et al., 2013). Jaiswal and Dhar (2015) stated that the nature of an organisational innovation climate would logically lead to increased innovation in an organisation, and is supported by the findings of the researcher. Additionally, Gibson and Birkinshaw (2004) showed that when a supportive context is created, such as an organisational innovation climate, individuals can engage in contextual ambidexterity. Cerne et al. (2013) and Damanpour and Schneider (2006) also showed that an organisational innovation climate results in ambidexterity.

When looking at the relationship strengths between organisational innovation climate and exploitation and exploration, the SEM shows that exploration is supported more than exploitation as it has a higher coefficient (0.801 vs 0.704) and variance explained (64% vs 57%). Sarros et al. (2008) also found that the degree of support from an organisational innovation climate promotes explorative innovation. As Exploitation also has a significant positive relationship with complexity leadership (as shown above), the total effect of organisational innovation climate and complexity leadership on exploitation is 0.789 (0.704 + 0.085) in the SEM model. This shows a relationship strength that is close to organisational innovation climate and exploration. Again this is a function of SEM analysis, as all constructs and relationships are considered in the model (Babin & Svensson, 2012; Schumacker & Lomax, 2010). This result is supported in the literature, in that a leader creates the context of the organisational innovation climate and that the climate then results in innovation, therefore the leader and the climate are needed for innovation (Cerne et al., 2013; Damanpour & Schneider, 2006; Gibson & Birkinshaw, 2004; Uhl-bien & Arena, 2017).

The variance explained in the relationships shows that organisational innovation climate is a strong predictor of exploration, with a variance explained of 64%. Thus, an improvement in organisational innovation climate can greatly enhance exploration. The variance explained in exploitation is influenced by organisational innovation climate and complexity leadership and measured at 57%. However, as the regression coefficient of complexity leadership and exploitation is weak (0.085), organisational innovation climate is the most influential predictor in this relationship. Thus, an improvement in organisational innovation climate can greatly enhance exploitation. Various scholars support these findings, in that organisational innovation climate is an antecedent for contextual ambidexterity (Cerne et al., 2013; B. Schneider et al., 2016; Wang et al., 2013), and therefore this research confirms this relationship in that an organisational innovation climate is needed for both exploitation and exploration.

The researcher considered the population and context of the data explained, to explain further the results obtained. As described above, the majority of the population was from older organisations of 10 years or more. These organisations are more likely to have traditional leadership styles than that of complexity leadership (Uhl-bien & Arena, 2017). The researcher

suspects that this population may value the organisational innovation climate higher than the leader in supporting contextual ambidexterity. Hence the significant and positive relationship between organisational innovation climate with exploitation and exploration, compared to that of complexity leadership only supporting exploitation. Literature on innovation and complexity leadership is lacking (Avolio et al., 2009; Mendes et al., 2016) and this relationship will need further investigation in future.

From the data analysis and the support of current theory, the researcher can conclude that organisational innovation climate has a strong positive linear relationship with exploitation and exploration, and therefore contextual ambidexterity. An increase in organisational innovation climate will lead to an increase in contextual ambidexterity. Organisational innovation climate is also a significant predictor of exploitation and exploration. Objective 3 of this research has therefore been met satisfactorily.

6.5. OBJECTIVE 4: Organisational Innovation Climate as a Mediator

Objective 4: Determine if organisational innovation climate has a mediating effect on the relationship between complexity leadership and contextual ambidexterity (exploitation and exploration).

6.5.1. Results from data analysis

Mediation Analysis Results

A summary of the results from the mediation analysis are in Table 26 below:

Table 26: Objective 4 - Mediation analysis

Objective 4	Mediation Results
Hypothesis 4a: accept the Alternate - $H_1$4a	• Organisational innovation climate partially mediates the effect of complexity leadership on exploitation. • The direct effect of complexity leadership on exploitation is significant and positive (*p*-value .025 and coefficient .085). However, the indirect effect of complexity leadership on exploitation via the mediator remains significant (*p*-value .001) with an increased positive effect (coefficient .396). • This, therefore, indicates partial mediation.
Hypothesis 4b: accept the Alternate - $H_1$4b	• Organisational innovation climate totally mediates the effect of complexity leadership on exploration. • The direct effect of complexity leadership on exploration is not significant (*p*-value .812) and negative (coefficient -.006). The indirect effect of complexity leadership on exploration via the mediator is however significant (*p*-value .001) and positive (coefficient .450). • Therefore, the criteria of total mediation are met.

6.5.2. Comparison to existing literature

Charbonnier-Voirin et al. (2010) established that organisational innovation climate played a moderating role between leadership and innovation. This study shows that organisational innovation climate can also play a mediating role in the relationship between leadership and

innovation. This study supports the findings of Berson et al. (2006) that showed the mediating effects of the organisational context on both exploration and exploitation. Several other studies also supported the mediating role of climate on innovation (B. Schneider et al., 2016). Literature has expressed that further mediation studies looking at various leadership styles, especially complexity-based models, is needed (Avolio et al., 2009; Berson et al., 2006; M. Schneider & Somers, 2006). This was, therefore, one of the objectives of the researcher.

As shown and discussed above, the SEM structural model shows how complexity leadership has an indirect effect on exploration and exploitation through the organisational innovation climate. Therefore, leaders must create the context if they want to enable effective exploitation and exploration. It is the goal of complexity leadership to recognise what climate will generate creative ideas and drive adaptability, learning and the innovative process (Uhl-Bien et al., 2007). The mediation analysis supports this further by showing the importance of the organisational innovation climate in the relationship. Although complexity leadership had a significant relationship with exploitation, it was weak at 0.085. With the organisational innovation climate as a mediator in this relationship, the coefficient is 0.396. Complexity leadership had no significant relationship with exploration, but when the mediator of organisational innovation climate is added the relationship is significant and positive with a coefficient of 0.450. Thus, Complexity leadership must create this organisational innovation climate to enable contextual ambidexterity.

The enabling conditions of an organisational innovation climate, as it relates to complexity leadership, is described by Arena and Uhl-Bien (2016) as adaptive space. Arena and Uhl-Bien (2016) state that this adaptive space “occurs in the interface between the operational and the entrepreneurial system” (p.24). The mediation analysis of this research shows the importance of the organisational innovation climate both as a mediator and an independent variable. Therefore, this is an area in which future research could focus, to understand the full importance of this construct within Complexity Leadership Theory and work on its measurement scales, as its effects on contextual ambidexterity are significant and positive.

The total effect of complexity leadership on exploitation and exploration is shown in Table 22 above. These results show the total effect that complexity leadership has on exploitation and exploration and is the sum of the direct and indirect (via the mediator) effects. These results are interesting, as these total effects are less than the direct effect of organisational innovation climate on contextual ambidexterity. The researcher suspects that these results show that climate literature is more established than that of complexity leadership, as shown by various scholars (Avolio et al., 2009; Berson et al., 2006; Sarros et al., 2008; M. Schneider & Somers, 2006). Additionally, the respondent context may explain some of these findings, as described above, in that the climate is considered more important than complexity leadership in driving

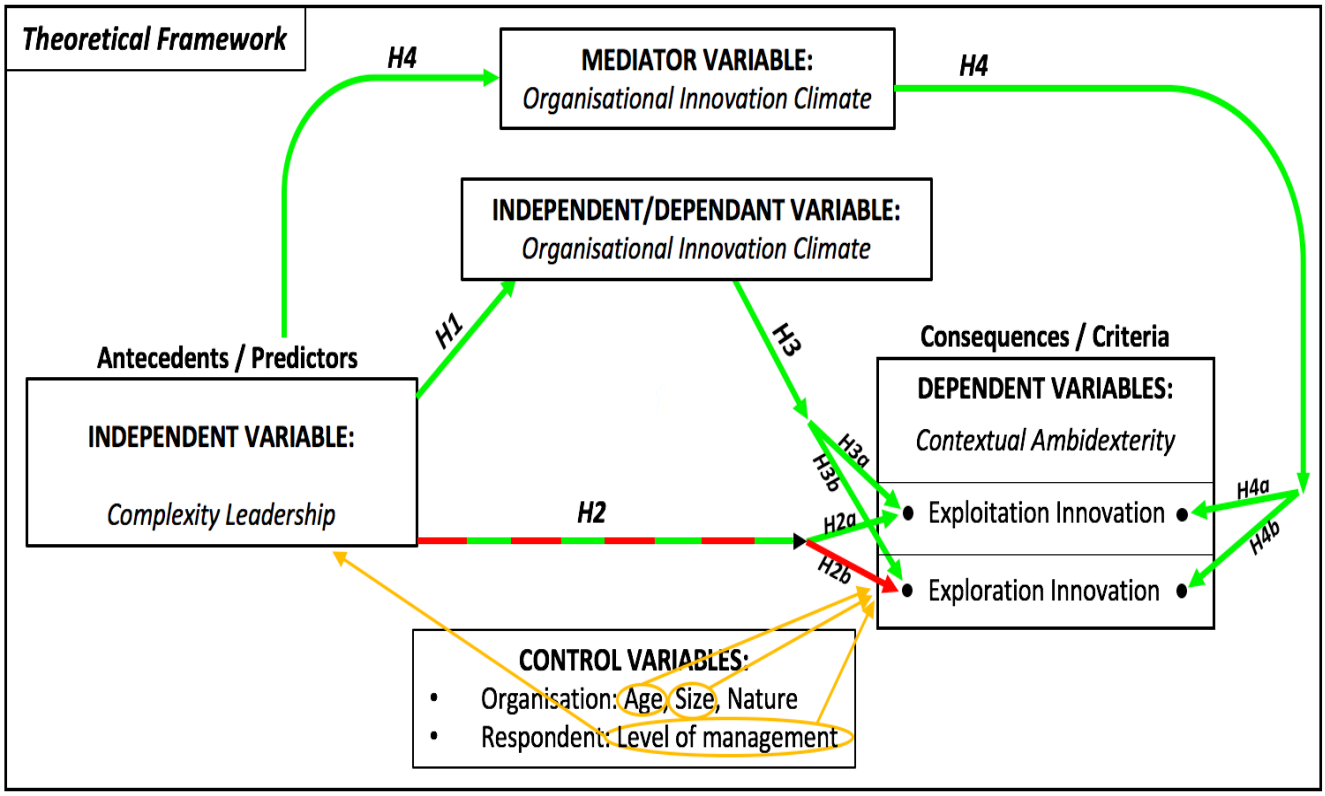
innovation, and is reflected in the literature with organisational innovation climate receiving a great amount of attention (Sarros et al., 2008).

Therefore, from the mediation analysis, and the literature reviewed, the researcher can conclude that organisational innovation climate is a mediator in the relationship between complexity leadership and contextual ambidexterity. Organisational innovation climate partially mediates the relationship between complexity leadership and exploitation, adding strength to the relationship. Organisational innovation climate totally mediates complexity leadership and exploration, enabling a significant positive relationship. Thus, complexity leadership must create this organisational innovation climate to enable contextual ambidexterity. Objective 4 of this research has therefore been met satisfactorily.

6.6. CHAPTER CONCLUSION

This chapter discussed the results and their meaning, and whether they supported, contradicted or added to current literature. All objectives set out by the researcher were met, and insights gained explained. These insights are summarised in the revised conceptual model shown in Figure 18 below. The green arrows indicate a significant positive relationship, red a non-significant relationship, and orange the possible influence control variables had on the model.

Figure 18: Revised model and relationships



The final chapter will summarise the findings of this research. The implications of these findings for business will be explored, as well as the future directions for further research and the limitations of this study.

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7. RECOMMENDATIONS & CONCLUSION

This chapter highlights the main findings of this research. Informed by the above in Sections 5 and 6, implications of these findings are suggested for business. Limitations that informed or restricted the study are set out, and avenues for future research are proposed.

7.1. SUMMARY OF FINDINGS

This study had four objectives, with the primary objective driven by the research title: organisational innovation climate as a mediator of the relationship between complexity leadership and contextual ambidexterity. The study, therefore, found that:

- ***Organisational innovation climate is a mediator of the relationship between complexity leadership and contextual ambidexterity.*** Organisational innovation climate partially mediated the relationship with exploitation and totally mediated the relationship between the complexity leadership and exploration.
- ***Complexity leadership has a positive influence on organisational innovation climate***. Leadership is key in the creation of this climate.
- ***Complexity leadership has a positive influence on exploitation Innovation***. Complexity leadership has a weak but significant positive influence on exploitation, but no significant influence on exploration.
- ***Organisational innovation climate has a positive influence on contextual ambidexterity.*** Organisational innovation climate has a significant and positive influence on exploitation and exploration.

7.2. IMPLICATIONS FOR BUSINESS

From the findings above, recommendations of interventions that can possibly improve management and performance can be implied. From the relationships explored and analysed, the link and intricacies of said relationships between complexity leadership, organisational innovation climate and contextual ambidexterity provide possible avenues for organisations and managers to use in today's business landscape. These avenues are:

Complexity leadership creates an organisational innovation climate

Today's business landscape is showing increasing aspects of uncertainty and ambiguity captured in the term "complexity" (Clarke, 2013; Uhl-bien & Arena, 2017). This has led to an interest in leadership theories that can deal with this complexity and the context that organisations face (Dinh et al., 2014; Havermans et al., 2015). Complexity leadership focuses on a model that enables leadership in a complex system by enabling it to adapt to the complexity it faces (Uhl-Bien, Marion, & McKelvey, 2007).

This research showed that complexity leadership could be used to create an organisational innovation climate, that is likely to then enable contextual ambidexterity. This can, therefore,

promote simultaneous exploitation and exploration innovation that will allow the organisation to adapt. Thus complexity leadership is added to the leadership styles that create a climate that can foster innovation (Jaiswal & Dhar, 2015; B. Schneider et al., 2016).

Therefore, leadership training and development can focus on complexity leadership, and its typical activities and attributes, to create the adaptive space to allow for the creation of an organisational innovation climate. These attributes, as described in the literature and measurement scales, are patterning of attention, developing networks and contextual intelligence (Kutz, 2008; Kutz & Bamford-Wade, 2013; Osborn et al., 2002; Osborn & Marion, 2009; Uhl-bien & Arena, 2017; Uhl-Bien et al., 2007). The measurement scales provide practical guidelines for the development of these skills. For example, to improve patterning of attention, a leader can encourage employees to raise difficult and challenging questions that others may perceive as a threat to the status quo. The leader can develop networks by bridging organisational boundaries/silos and functions. Contextual intelligence can be improved by leadership foresight and giving the organisation a sense of direction for where it is going in the future.

Organisations should, therefore, take note of this emerging leadership theory. Scholars have also seen the movement towards leadership theories that incorporate a systems view and complexity science (Clarke, 2013). Further advantages of incorporating complexity leadership can lead to businesses being able to better adapt to change, as business leaders are facing escalating challenges in complex environments (Clarke, 2013; Uhl-bien & Arena, 2017). Examples of these challenges are the global financial crisis and political instability globally and in the South African context (Uhl-bien & Arena, 2017). Therefore, the researcher is of the view that complexity leadership is a leadership theory that business should take note of.

Organisational innovation climate enables contextual ambidexterity

This research showed that organisational innovation climate has a significant and positive influence on contextual ambidexterity, and therefore exploitation and exploration. It supported the findings in the literature that organisational innovation climate is an antecedent of contextual ambidexterity (Cerne et al., 2013; Charbonnier-Voirin et al., 2010; Jaiswal & Dhar, 2015; Sarros et al., 2008; B. Schneider et al., 2016; Wang et al., 2013). Thus, management should take note of the climate in their organisation and strive to create one that supports innovation, such as the organisational innovation climate described in this study.

Contextual ambidexterity is considered essential for organisations to stay competitive and is required for long-term survival (De Clercq et al., 2014; Nemanich & Vera, 2009; Tushman & O'Reilly, 1996). It should, therefore, be a goal of all organisations to enable contextual ambidexterity, and this study has provided insights on how to achieve this. Additionally, the

strength of the relationship that this research showed, between an organisational innovation climate and exploitation and exploration, cannot be ignored. As stated by De Clercq et al., (2014) “to remain competitive, firms must be ambidextrous” (p. 24).

How can organisations achieve this? Looking at the first implication described above, organisations could find or train a leader in complexity leadership skills (such as developing networks, contextual intelligence and patterning of attention) that will create this organisational innovation climate for the organisation, and therefore enable contextual ambidexterity. This organisational innovation climate also acts as a mediator that enables complexity leadership to be more effective in enabling innovation and leads to the next point.

Organisational innovation climate is an important mediator

The researcher found evidence that organisational innovation climate mediates the relationship between complexity leadership and contextual ambidexterity. Although complexity leadership had a significant positive relationship with exploitation, its effects were stronger through the mediator, and the mediator was required for complexity leadership to have a significant influence on exploration. Therefore, an organisational innovation climate is needed for complexity leadership to be effective in enabling contextual ambidexterity. This research added to the mediating role that climate plays in innovation, by adding Complexity Leadership Theory to the styles investigated (Berson et al., 2006; B. Schneider et al., 2016; M. Schneider & Somers, 2006).

Looking at the context of this study, the respondents valued organisational innovation climate highly in enabling contextual ambidexterity, and as a mediator. Most of these respondents were from large organisations of more than 1000 employees, and organisations were older than ten years. Therefore, managers in such organisations should take note of the importance placed on organisational innovation climate by employees to enable contextual ambidexterity, and mediate the relationship with complexity leadership.

Again, we can look at the measurement scales for guidance for organisations to create an organisational innovation climate. Effective systems that allow for the integration of innovative products and processes into the organisational system and structures, as well as encouraging employees to experiment with the new ideas and products will help in building this climate. Organisations also needs to protect innovative groups and processes against bureaucratic organisational forces, which is pertinent for organisations that have a similar structure to those in this study (large and older than ten years).

What does this mediation mean practically for business? This study shows that both organisational innovation climate and complexity leadership is needed to create the most

beneficial relationship between the constructs that can drive and enable contextual ambidexterity to their greatest effect. In other words, having just one or the other will not be as effective as having both. Therefore, and leading on from the insights above, organisations should enable the development of complexity leadership, that will contribute to an organisational innovation climate. This organisational innovation climate can enable contextual ambidexterity directly, but also enable complexity leadership to promote contextual ambidexterity via the mediator of the organisational innovation climate that the leader has created; therefore, increasing the chances of innovation and organisation success.

7.3. LIMITATIONS

All research has limitations and must be understood by the researcher as it helps identify weaknesses that may influence the extent of the usefulness of the study (Creswell, 2012). Further to limitations set out in section 4.7 on the research design, the researcher identified limitations of the research topic and constructs, and retrospectively on the research design. The following limitations are worth adding or reiterating:

7.3.1. Research topic

- The researcher experienced similar limitations to the research as highlighted in literature, namely:
    - The research focused on complexity leadership and did not provide analysis of other leadership styles. It must be noted that although complexity leadership provides a powerful leadership lens, that "complexity leadership is not a panacea for our leadership problems" (Brown, 2011, p. 20). Even the combination of adaptive, administrative and enabling leadership that makeup CLT leaves out key epistemologies that provide valuable data on any leadership situation (Brown, 2011).
    - The theory of complexity also has limitations, as Cilliers (2000) states that a theory of complexity cannot help us to take specific positions, or to make accurate predictions. Therefore, looking at the aspects of complexity, it can only provide a general set of guidelines (Cilliers, 2000).
    - In the organisational context, this research only addresses the construct of organisational innovation climate and not that of culture. Research that simultaneously studies organisational climate and culture may more fully capture the reality of organisational life and yield more considerable improvement in performance (B. Schneider et al., 2013)
- The measurement scales used for complexity leadership and organisational innovation climate were created and used for the first time in this research, as no known scales exist. These scales would need to be tested further in future research and possibly refined.

7.3.2. Research Design & Data

- The sampling method and population resulted in the majority of respondents from large and old organisations, and this may have affected results as described above.
- The study was limited geographically to South Africa and may limit its applicability to a broader international context.
- A cross-sectional design does not allow for analysis of trends over time and is just a snapshot of the current context.
- The scale used for complexity leadership had 19 items and should be refined to fewer items to help with a more comfortable grasp of the construct and reduce respondent fatigue.
- Some constructs had validity and correlation concerns and will need to be addressed in future studies, and the measurement scales improved.
- It must also be accepted that full mediation cannot be measured or claimed by the research, as to claim full mediation all possible mediators and suppressors have to be measured (Rucker et al., 2011).

7.4. FUTURE RESEARCH

From the findings and limitations of this study, the researcher can make recommendations for future research. These include, but are not limited to, the research design, constructs used and the measurement instrument. These recommendations are set out below.

- The sample population should include respondents from a variety of geographical locations, and beyond South African borders to provide a more global perspective.
- A cross-sectional design will allow for possible trends to be established as the context changes
- The researcher used a pragmatic and explanatory approach. It can be argued that a mixed method approach be more suited to pragmatism, and can then also be explanatory (Dudovskiy, 2013). An explanatory approach may add more to theory and provide a higher level of insights to guide further research.
- Although SEM has gained much popularity as a method in recent literature, its value and applicability have been challenged (Babin & Svensson, 2012; Svensson, 2015). Other analysis tools, such as multiple regression, can be used to confirm the findings in this study and may add additional insights.
- The measurement instrument used a five (5) point Likert scale, and as the accuracy of measuring the relationships of the constructs increases as the range of the constructs increases, this limited range will reduce the SEM output precision (Schumacker & Lomax, 2010). A scale with more points may improve accuracy and results.
- The measurement scale used for complexity leadership was created by the researchers, as no known scales exist. This scale needs to be tested in future research

and possibly refined to fewer items to develop a recognised scale for complexity leadership further. Future research can also use the three sub-constructs (patterning of attention, development of networks, and contextual intelligence) to ascertain their relationships to contextual ambidexterity, to add further depth to theory and understanding.

- The concept of the adaptive space in Complexity Leadership Theory will benefit the understanding of this theory
- The organisational innovation climate scale was created by the researchers, as no known scales exist. Due to the strong relationship that is shown in this study between organisational innovation climate and contextual ambidexterity, future testing and evaluation should be explored. Additionally, organisational innovation climate can be tested as a mediator in other leadership styles and relationships.
- Research that simultaneously studies organisational climate and culture will more fully capture the reality of organisational life and yield greater improvement in performance (B. Schneider et al., 2013). Therefore, organisational culture can be added to the model as a construct for analysis.

7.5. CHAPTER CONCLUSION

This chapter concluded the research by; summarising the main findings; giving practical implications for business; drew attention to the limitations; and provided recommendations for future research.

The literature showed that leadership plays an important role in developing contextual ambidexterity, and creating an organisational innovation climate (Gibson & Birkinshaw, 2004; Raisch & Birkinshaw, 2008; B. Schneider et al., 2016; Uhl-Bien et al., 2007). This study supports these findings and shows how complexity leadership can create an organisational innovation climate that can support contextual ambidexterity, and how this climate can mediate and increase the effectiveness of the leader.

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9. APPENDIX A

Table 27: Research questionnaire

Participant consent
Q1. Research purpose and consent
Biographical questions
Q2. Age of respondent Q3. Gender Q4. Level of education Q5. Race group Q6. Tenure Q7. Discipline
Control Variables
Q8. Level of management Q9. Size of organisation Q10. Age of organisation Q11. Bureaucratic or Entrepreneurial
Dependent Variable (Criteria or called Consequences)
Innovation *(Jansen, van den Bosch, and Volberda (2006); as adapted by Jansen, Vera, and Crossan (2009))* **1) Exploratory innovation** 1. We invent new products and services (Q12_1) 2. Our organization accepts demands that go beyond existing products and services (Q12_2) 3. We experiment with new products and services in our local market (Q12_3) 4. We commercialize products and services that are completely new to our organisation (Q12_4) 5. We frequently utilize new opportunities in new markets (Q12_5) 6. Our organization regularly uses new distribution channels (Q12_6) 7. We regularly search for and approach new clients in new markets (Q12_7) **2) Exploitative innovation** 1. We frequently refine the provision of existing products and services (Q12_8) 2. We regularly implement small adaptations to existing products and services (Q12_9) 3. We introduce improved, but existing products and services for our local market (Q12_10) 4. We improve our provision's efficiency of products and services (Q12_11) 5. We increase economies of scales or cost advantages due to scale or size of operation in existing markets (Q12_12) 6. Our organization expands services for existing clients (Q12_13) 7. Lowering costs of internal processes is an important objective (Q12_14)
Mediator Variable
Organisational innovation climate *6 statements were developed by the creators of the questionnaire from the work of Arena and Uhl-Bien (2016)* 1. Informal groupings are seen as a valuable source for effective change (Q12_20) 2. Our organisation has effective systems for integrating new innovative products and processes back into the organisational systems and structures (Q12_21) 3. Our organisation has an enabling climate for innovation (Q12_22)

4. Our organisation involves employees on the frontline and customers to innovate our products and services (Q12_23)
5. Our organisation values experimentation with new ideas and processes (Q12_24)
6. Our organisation protects innovative groups and processes against the bureaucratic organisational forces (Q12_25)

Independent Variable (Predictors or called Antecedents)

complexity leadership:

a) Patterning of attention (Osborn & Marion, 2009)**:**

1. Facilitates dialog and discussion to help employees share knowledge in developing a shared understanding of issues (Q13_4)
2. Initiates discussions on what is important, not what to do and how to do it (Q13_5)
3. Connects employees with a broad variety of potential information sources such as those people with relevant information (Q13_6)
4. Injects ideas and information into the system for it to process to create energy for change (Q13_16)
5. Tells stories to illustrate important learning points (Q13_17)
6. Encourages employees to raise difficult and challenging questions that others may perceive as a threat to the status quo (Q13_18)

b) Developing networks (Osborn, 2008; Uhl-Bien et al., 2007)**:**

1. Creates linkages between entities inside the organisation and with outside stakeholders (Q13_19)
2. Has political skill of sizing up group politics for the benefit of the department or business unit (Q13_20)
3. Displays political savvy in understanding the interests of the other players in organisational networks (Q13_21)
4. Builds networks across internal organisational boundaries/ silos or functions (Q13_22)
5. Embraces diversity by having diverse people and views as part of the network (Q13_23)
6. Gathers feedback information from external stakeholders such as suppliers and customers to improve the organisation (Q13_24)

c) Contextual Intelligence (Kutz, 2008)**:**

1. Gathers intelligence from what is happening in the context like which threats and opportunities are developing (Q13_25)
2. Demonstrates being in tune with the organisational and external environment or context (Q13_26)
3. Frames our change projects in ways that appeal or speaks to the interest of particular stakeholders (Q13_27)
4. Adapts his/her communication to different ethnic cultures in the organisation (Q13_28)
5. Investigates relevant contextual variables that are or might influence the organisation (Q13_29)
6. Has a forward-looking mentality - sense of direction for where the organisation is going in the future (Q13_30)
7. Provide opportunities for diverse employees to interact in a non-discriminatory manner (Q13_31)

Figure 19: Exploitation - Exploration framework.

Source: Lavie, D., Stettner, U., & Tushman, M.L. (2010).

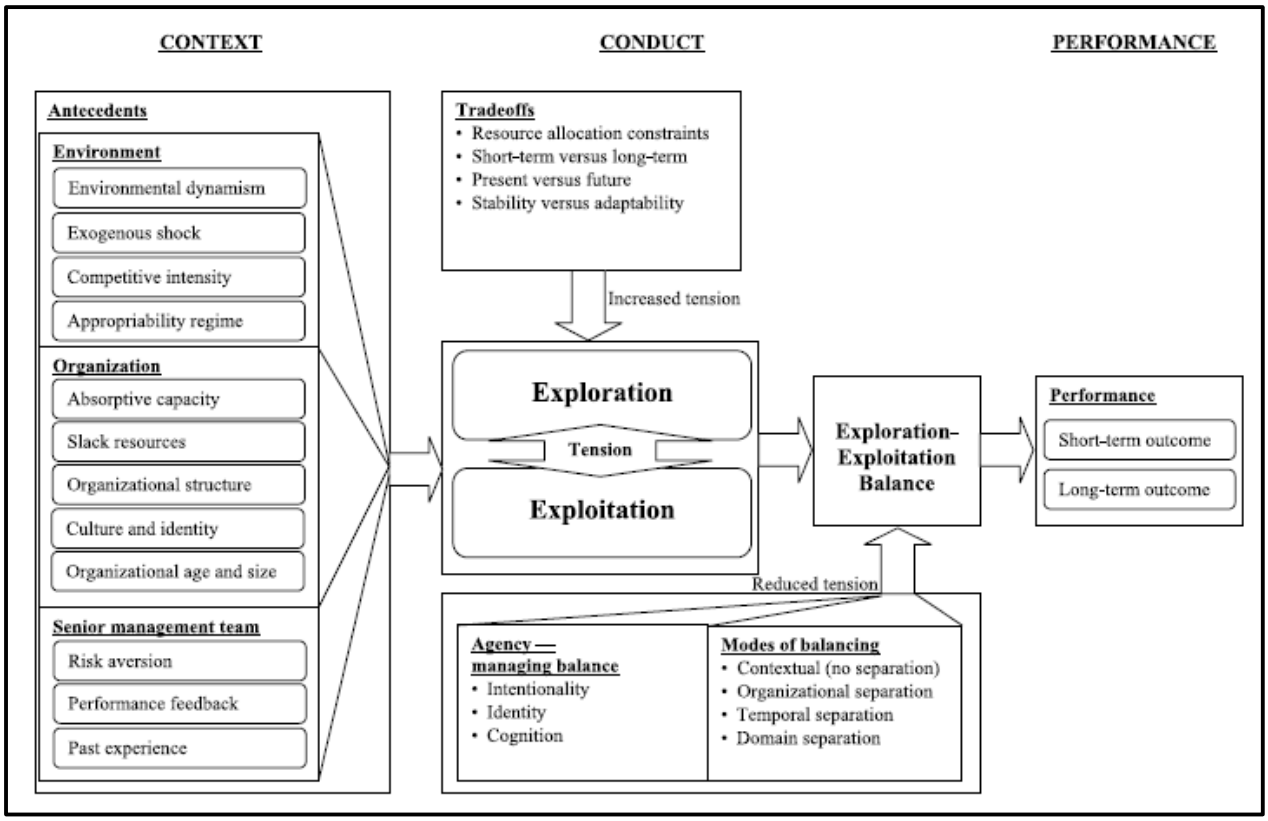

Table 28: Reliability statistics organisational innovation climate

Reliability Statistics

Cronbach's Alpha	Cronbach's Alpha Based on Standardized Items	N of Items
0,895	0,893	6

Inter-Item Correlation Matrix

	OrganisationalInnovationClimateContex1	OrganisationalInnovationClimateContex2	OrganisationalInnovationClimateContex3	OrganisationalInnovationClimateContex4	OrganisationalInnovationClimateContex5	OrganisationalInnovationClimateContex6
OrganisationalInnovationClimateContex1	1,000	0,473	0,411	0,431	0,417	0,458
OrganisationalInnovationClimateContex2	0,473	1,000	0,625	0,558	0,581	0,579
OrganisationalInnovationClimateContex3	0,411	0,625	1,000	0,695	0,744	0,674
OrganisationalInnovationClimateContex4	0,431	0,558	0,695	1,000	0,729	0,653
OrganisationalInnovationClimateContex5	0,417	0,581	0,744	0,729	1,000	0,701
OrganisationalInnovationClimateContex6	0,458	0,579	0,674	0,653	0,701	1,000

Table 29: Reliability statistics independent variable

Reliability Statistics

Cronbach's Alpha	Cronbach's Alpha Based on Standardized Items	N of Items
0,962	0,962	19

Inter-Item Correlation Matrix

	ComplexityLeadershipPatterningOfAttention1	ComplexityLeadershipPatterningOfAttention2	ComplexityLeadershipPatterningOfAttention3	ComplexityLeadershipPatterningOfAttention4	ComplexityLeadershipPatterningOfAttention5	ComplexityLeadershipPatterningOfAttention6	ComplexityLeadershipDevelopingNetwork1	ComplexityLeadershipDevelopingNetwork2	ComplexityLeadershipDevelopingNetwork3	ComplexityLeadershipDevelopingNetwork4	ComplexityLeadershipDevelopingNetwork5	ComplexityLeadershipDevelopingNetwork6	ContextualIntelligence1	ContextualIntelligence2	ContextualIntelligence3	ContextualIntelligence4	ContextualIntelligence5	ContextualIntelligence6	ContextualIntelligence7
ComplexityLeadershipPatterningOfAttention1	1,000	0,756	0,685	0,671	0,609	0,599	0,581	0,502	0,468	0,562	0,590	0,541	0,546	0,544	0,534	0,473	0,520	0,543	0,592
ComplexityLeadershipPatterningOfAttention2	0,756	1,000	0,686	0,685	0,622	0,647	0,605	0,488	0,451	0,536	0,570	0,566	0,565	0,552	0,531	0,494	0,562	0,555	0,573
ComplexityLeadershipPatterningOfAttention3	0,685	0,686	1,000	0,751	0,650	0,634	0,671	0,490	0,449	0,578	0,588	0,584	0,586	0,584	0,568	0,502	0,589	0,566	0,584
ComplexityLeadershipPatterningOfAttention4	0,671	0,685	0,751	1,000	0,682	0,676	0,684	0,483	0,467	0,574	0,596	0,594	0,599	0,594	0,591	0,517	0,606	0,598	0,584
ComplexityLeadershipPatterningOfAttention5	0,609	0,622	0,650	0,682	1,000	0,637	0,618	0,516	0,458	0,506	0,531	0,509	0,554	0,537	0,536	0,508	0,540	0,515	0,534
ComplexityLeadershipPatterningOfAttention6	0,599	0,647	0,634	0,676	0,637	1,000	0,656	0,497	0,462	0,539	0,583	0,541	0,561	0,569	0,555	0,507	0,569	0,551	0,593
ComplexityLeadershipDevelopingNetwork1	0,581	0,605	0,671	0,684	0,618	0,656	1,000	0,515	0,495	0,571	0,563	0,582	0,560	0,568	0,560	0,493	0,580	0,540	0,547

ComplexityLeadershipDevelopingNetwork2	0,502	0,488	0,490	0,483	0,516	0,497	0,515	1,000	0,806	0,615	0,530	0,465	0,514	0,539	0,514	0,455	0,500	0,469	0,467
ComplexityLeadershipDevelopingNetwork3	0,468	0,451	0,449	0,467	0,458	0,462	0,495	0,806	1,000	0,629	0,566	0,476	0,549	0,565	0,486	0,465	0,489	0,491	0,484
ComplexityLeadershipDevelopingNetwork4	0,562	0,536	0,578	0,574	0,506	0,539	0,571	0,615	0,629	1,000	0,689	0,566	0,620	0,608	0,565	0,480	0,548	0,548	0,552
ComplexityLeadershipDevelopingNetwork5	0,590	0,570	0,588	0,596	0,531	0,583	0,563	0,530	0,566	0,689	1,000	0,608	0,642	0,619	0,576	0,553	0,586	0,627	0,700
ComplexityLeadershipDevelopingNetwork6	0,541	0,566	0,584	0,594	0,509	0,541	0,582	0,465	0,476	0,566	0,608	1,000	0,737	0,661	0,587	0,525	0,613	0,557	0,527
ContextualIntelligence1	0,546	0,565	0,586	0,599	0,554	0,561	0,560	0,514	0,549	0,620	0,642	0,737	1,000	0,767	0,604	0,512	0,666	0,624	0,560
ContextualIntelligence2	0,544	0,552	0,584	0,594	0,537	0,569	0,568	0,539	0,565	0,608	0,619	0,661	0,767	1,000	0,618	0,536	0,652	0,635	0,596
ContextualIntelligence3	0,534	0,531	0,568	0,591	0,536	0,555	0,560	0,514	0,486	0,565	0,576	0,587	0,604	0,618	1,000	0,573	0,632	0,579	0,580
ContextualIntelligence4	0,473	0,494	0,502	0,517	0,508	0,507	0,493	0,455	0,465	0,480	0,553	0,525	0,512	0,536	0,573	1,000	0,665	0,532	0,567
ContextualIntelligence5	0,520	0,562	0,589	0,606	0,540	0,569	0,580	0,500	0,489	0,548	0,586	0,613	0,666	0,652	0,632	0,665	1,000	0,675	0,600
ContextualIntelligence6	0,543	0,555	0,566	0,598	0,515	0,551	0,540	0,469	0,491	0,548	0,627	0,557	0,624	0,635	0,579	0,532	0,675	1,000	0,639
ContextualIntelligence7	0,592	0,573	0,584	0,584	0,534	0,593	0,547	0,467	0,484	0,552	0,700	0,527	0,560	0,596	0,580	0,567	0,600	0,639	1,000

Table 30: Normality analysis

Variables	skew	kurtosis
OIC6	-.297	-.818
OIC5	-.749	-.276
OIC4	-.513	-.658
OIC3	-.745	-.357
OIC2	-.454	-.770
OIC1	-.282	-.425
Xploi1	-.832	.224
Xploi2	-.996	.733
Xploi3	-.924	.536
Xploi4	-.889	.464
Xploi5	-.675	-.137
Xploi6	-.904	.389
Xploi7	-1.052	.429
Xplo1	-.997	.177
Xplo2	-.950	.341
Xplo3	-.947	.166
Xplo4	-.651	-.432
Xplo5	-.718	-.386
Xplo6	-.347	-.748
Xplo7	-.786	-.231
CI7	-.708	-.360
CI6	-.866	.021
CI5	-.513	-.291
CI4	-.481	-.682

Variables	skew	kurtosis
CI3	-.517	-.152
CI2	-.678	-.127
CI1	-.630	-.240
DN6	-.568	-.357
DN5	-.724	-.246
DN4	-.561	-.469
DN3	-.453	-.622
DN2	-.327	-.774
DN1	-.355	-.791
PA6	-.464	-.784
PA5	-.405	-.714
PA4	-.505	-.530
PA3	-.518	-.463
PA2	-.664	-.166
PA1	-.562	-.288

Table 31: Descriptive statistics

Age					
		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	20-30 year old	341	28.3	28.3	28.3
	31-40 year old	506	42.0	42.0	70.3
	41-50 year old	246	20.4	20.4	90.8
	51-60 year old	111	9.2	9.2	100.0
	Total	1204	100.0	100.0	

Gender					
		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Male	737	61.2	61.2	61.2
	Female	467	38.8	38.8	100.0
	Total	1204	100.0	100.0	

Education					
		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Matric	166	13.8	13.8	13.8
	Diploma	283	23.5	23.5	37.3
	Undergraduate degree	312	25.9	25.9	63.2
	Postgraduate degree	443	36.8	36.8	100.0
	Total	1204	100.0	100.0	

Race					
		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Asian	36	3.0	3.0	3.0
	Black	417	34.6	34.6	37.6
	Coloured	60	5.0	5.0	42.6
	Indian	175	14.5	14.5	57.1
	White	511	42.4	42.4	99.6
	6	5	.4	.4	100.0
	Total	1204	100.0	100.0	

Organisation Tenure					
		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	0-2 years	272	22.6	22.6	22.6
	3-5 years	316	26.2	26.2	48.8
	6-10 years	361	30.0	30.0	78.8
	11-15 years	255	21.2	21.2	100.0
	Total	1204	100.0	100.0	

Organisation Type					
		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Education or Services	28	2.3	2.3	2.3
	Education/ Services	36	3.0	3.0	5.3
	Engineering Professional services	30	2.5	2.5	7.8
	Engineering services	14	1.2	1.2	9.0
	Financial services	31	2.6	2.6	11.5
	Financial services/ Insurance	30	2.5	2.5	14.0
	Financial services/Banking	103	8.6	8.6	22.6
	Financial Services/Banking	53	4.4	4.4	27.0
	Government	21	1.7	1.7	28.7
	Information Technology services	33	2.7	2.7	31.5
	IT services	34	2.8	2.8	34.3
	Law firm Professional Services	27	2.2	2.2	36.5
	Logistics	27	2.2	2.2	38.8
	Manufacturing	218	18.1	18.1	56.9
	Manufacturing/ Architecture	15	1.2	1.2	58.1
	Medical aid (Financial services?)	25	2.1	2.1	60.2
	Mining	75	6.2	6.2	66.4
	Mining/ manufacturing (smelters)	22	1.8	1.8	68.3
	NGO	24	2.0	2.0	70.3
	Petrochemical/ SOC?	63	5.2	5.2	75.5
	Professional services	34	2.8	2.8	78.3
	Retail	56	4.7	4.7	83.0
	SOC	46	3.8	3.8	86.8
	SOC Gov Owned Engineering Infrastructure	62	5.1	5.1	91.9
	SOC Gov Owned Utility	18	1.5	1.5	93.4
	Telecom / services?	49	4.1	4.1	97.5
	Utility SOC?	30	2.5	2.5	100.0
	Total	1204	100.0	100.0	

Discipline					
		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Finance	148	12.3	12.3	12.3
	Human resource	47	3.9	3.9	16.2
	Information Technology	153	12.7	12.7	28.9
	Marketing	31	2.6	2.6	31.5
	Operations	261	21.7	21.7	53.2
	Projects	121	10.0	10.0	63.2
	Research and development	79	6.6	6.6	69.8
	Sales	86	7.1	7.1	76.9
	Others	278	23.1	23.1	100.0
	Total	1204	100.0	100.0	

Organisation Level					
		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Staff	404	33.6	33.6	33.6
	Supervisor	99	8.2	8.2	41.8
	Middle manager	434	36.0	36.0	77.8
	Senior manager	156	13.0	13.0	90.8
	Executive	51	4.2	4.2	95.0
	Others	60	5.0	5.0	100.0
	Total	1204	100.0	100.0	

Organisation Size					
		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	1-50 employees	66	5.5	5.5	5.5
	51-100 employees	108	9.0	9.0	14.5
	101-200 employees	74	6.1	6.1	20.6
	201-500 employees	147	12.2	12.2	32.8
	501-1000 employees	173	14.4	14.4	47.2
	More than 1000 employees	636	52.8	52.8	100.0
	Total	1204	100.0	100.0	

Organisation Age					
		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	less than a year	3	.2	.2	.2
	1-3 years	17	1.4	1.4	1.7
	4-5 years	41	3.4	3.4	5.1
	6-10 years	64	5.3	5.3	10.4
	More than10 years	1079	89.6	89.6	100.0
	Total	1204	100.0	100.0	

Organisation Type					
		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Bureaucratic	579	48.1	48.1	48.1
	Entrepreneurial	625	51.9	51.9	100.0
	Total	1204	100.0	100.0	

Table 32: Varimax rotation

	Component				
	Contextual Leadership	Exploration	Exploitation	Organisation Innovative Climate	5
Xplo1		.767			
Xplo2		.737			
Xplo3		.803			
Xplo4		.770			
Xplo5		.639	.344	.306	
Xplo6		.567	.306	.379	
Xplo7		.548	.418		
Xploi1		.413	.664		
Xploi2		.366	.645		
Xploi3		.437	.665		
Xploi4			.724		
Xploi5			.695		
Xploi6		.386	.566		
Xploi7			.631		
PA1	.713				
PA2	.716				
PA3	.732				
PA4	.737				
PA5	.692				
PA6	.718				
DN1	.708				
DN2	.749				
DN3	.752				
DN4	.782				
DN5	.783				
DN6	.727				
CI1	.784				
CI2	.788				
CI3	.733				
CI4	.676				
CI5	.757				
CI6	.738				
CI7	.740				
OIC1				.562	
OIC2			.355	.640	
OIC3		.337		.711	
OIC4		.332		.686	
OIC5		.352		.710	
OIC6		.302		.718	

Extraction Method: Principal Component Analysis.

Rotation Method: Varimax with Kaiser Normalization.[a]

a. Rotation converged in 6 iterations.

Table 33: Factor loadings - measurement model

			Estimate	P value
DN2	<---	CL	.682	***
DN3	<---	CL	.682	***
DN4	<---	CL	.769	***
DN5	<---	CL	.790	***
DN6	<---	CL	.762	***
Xplo7	<---	Xplo	.768	***
Xplo6	<---	Xplo	.809	***
Xplo5	<---	Xplo	.865	***
Xplo4	<---	Xplo	.713	***
Xplo3	<---	Xplo	.694	***
Xplo2	<---	Xplo	.659	***
Xplo1	<---	Xplo	.669	***
Xploi7	<---	Xploi	.527	***
Xploi6	<---	Xploi	.748	***
Xploi5	<---	Xploi	.738	***
Xploi4	<---	Xploi	.843	***
Xploi3	<---	Xploi	.813	***
Xploi2	<---	Xploi	.727	***
Xploi1	<---	Xploi	.775	***
OIC1	<---	OIC	.565	***
OIC2	<---	OIC	.730	***
OIC3	<---	OIC	.860	***
OIC4	<---	OIC	.847	***
OIC5	<---	OIC	.868	***
OIC6	<---	OIC	.825	***
PA1	<---	CL	.769	***
PA2	<---	CL	.793	***
PA3	<---	CL	.819	***
PA4	<---	CL	.832	***
PA5	<---	CL	.772	***
PA6	<---	CL	.790	***
DN1	<---	CL	.790	***
CI7	<---	CL	.776	***
CI6	<---	CL	.777	***
CI5	<---	CL	.790	***
CI4	<---	CL	.688	***
CI3	<---	CL	.774	***
CI2	<---	CL	.792	***
CI1	<---	CL	.787	***

*** indicates significant relationship at the level 0.0001

Table 34: Correlation estimates - measurement model

			Estimate	P value
CL	<-->	OIC	.562	***
Xploi	<-->	OIC	.751	***
Xplo	<-->	OIC	.797	***
CL	<-->	Xploi	.481	***
Xplo	<-->	Xploi	.815	***
CL	<-->	Xplo	.444	***
e16	<-->	e17	.285	***
e12	<-->	e13	.392	***
e8	<-->	e9	.669	***
e13	<-->	e14	.432	***
e1	<-->	e2	.431	***
e3	<-->	e4	.280	***
e32	<-->	e33	.341	***
e20	<-->	e21	.171	***
e24	<-->	e26	.417	***
e11	<-->	e19	.268	***
e23	<-->	e24	.367	***
e10	<-->	e11	.273	***
e17	<-->	e18	.205	***
e18	<-->	e19	.195	***
e25	<-->	e26	.396	***
e31	<-->	e32	.211	***
e24	<-->	e25	.345	***
e6	<-->	e7	.173	***
e23	<-->	e25	.217	***
e4	<-->	e5	.158	***
e12	<-->	e14	.207	***
e23	<-->	e26	.289	***

*** indicates significant relationship at the level 0.0001

Table 35: Inter-item correlation table (OIC, Xplo & Xploi)

		Xplo1	Xplo2	Xplo3	Xplo4	Xplo5	Xplo6	Xplo7
OIC1	Pearson Correlation	.333**	.351**	.320**	.337**	.397**	.442**	.372**
	Sig. (2-tailed)	0.000	0.000	0.000	0.000	0.000	0.000	0.000
	N	1204	1204	1204	1204	1204	1204	1204
OIC2	Pearson Correlation	.420**	.432**	.395**	.434**	.553**	.539**	.493**
	Sig. (2-tailed)	0.000	0.000	0.000	0.000	0.000	0.000	0.000
	N	1204	1204	1204	1204	1204	1204	1204
OIC3	Pearson Correlation	.506**	.494**	.476**	.485**	.574**	.561**	.502**
	Sig. (2-tailed)	0.000	0.000	0.000	0.000	0.000	0.000	0.000
	N	1204	1204	1204	1204	1204	1204	1204
OIC4	Pearson Correlation	.503**	.490**	.464**	.483**	.547**	.541**	.497**
	Sig. (2-tailed)	0.000	0.000	0.000	0.000	0.000	0.000	0.000
	N	1204	1204	1204	1204	1204	1204	1204
OIC5	Pearson Correlation	.524**	.499**	.541**	.514**	.560**	.542**	.477**
	Sig. (2-tailed)	0.000	0.000	0.000	0.000	0.000	0.000	0.000
	N	1204	1204	1204	1204	1204	1204	1204
OIC6	Pearson Correlation	.475**	.463**	.469**	.476**	.567**	.559**	.471**
	Sig. (2-tailed)	0.000	0.000	0.000	0.000	0.000	0.000	0.000
	N	1204	1204	1204	1204	1204	1204	1204

		Xploi1	Xploi2	Xploi3	Xploi4	Xploi5	Xploi6	Xploi7
OIC1	Pearson Correlation	.349**	.341**	.370**	.383**	.353**	.372**	.238**
	Sig. (2-tailed)	0.000	0.000	0.000	0.000	0.000	0.000	0.000
	N	1204	1204	1204	1204	1204	1204	1204
OIC2	Pearson Correlation	.469**	.420**	.449**	.510**	.486**	.510**	.355**
	Sig. (2-tailed)	0.000	0.000	0.000	0.000	0.000	0.000	0.000
	N	1204	1204	1204	1204	1204	1204	1204
OIC3	Pearson Correlation	.490**	.466**	.503**	.546**	.457**	.499**	.350**
	Sig. (2-tailed)	0.000	0.000	0.000	0.000	0.000	0.000	0.000
	N	1204	1204	1204	1204	1204	1204	1204
OIC4	Pearson Correlation	.470**	.457**	.495**	.533**	.451**	.526**	.327**
	Sig. (2-tailed)	0.000	0.000	0.000	0.000	0.000	0.000	0.000
	N	1204	1204	1204	1204	1204	1204	1204
OIC5	Pearson Correlation	.470**	.461**	.499**	.536**	.448**	.505**	.349**
	Sig. (2-tailed)	0.000	0.000	0.000	0.000	0.000	0.000	0.000
	N	1204	1204	1204	1204	1204	1204	1204
OIC6	Pearson Correlation	.460**	.435**	.466**	.542**	.460**	.478**	.329**
	Sig. (2-tailed)	0.000	0.000	0.000	0.000	0.000	0.000	0.000
	N	1204	1204	1204	1204	1204	1204	1204

Table 36: Correlation estimates - structural model

			Estimate	P value
e40	<-->	e41	.545	***
e16	<-->	e17	.285	***
e12	<-->	e13	.392	***
e8	<-->	e9	.669	***
e13	<-->	e14	.432	***
e1	<-->	e2	.431	***
e3	<-->	e4	.280	***
e32	<-->	e33	.341	***
e20	<-->	e21	.171	***
e24	<-->	e26	.417	***
e11	<-->	e19	.268	***
e23	<-->	e24	.367	***
e10	<-->	e11	.273	***
e17	<-->	e18	.205	***
e18	<-->	e19	.195	***
e25	<-->	e26	.396	***
e31	<-->	e32	.211	***
e24	<-->	e25	.345	***
e6	<-->	e7	.173	***
e23	<-->	e25	.217	***
e4	<-->	e5	.158	***
e12	<-->	e14	.207	***
e23	<-->	e26	.289	***

*** indicates significant relationship at the level 0.0001