Gordon Institute of Business Science
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Environmental dynamism as a moderator of the relationship between complexity leadership and contextual ambidexterity

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Abstract

Organisations need to implement both incremental innovation (exploitation), and radical innovation (exploration) to ensure success and survival. Exploitation improves the efficiency of current operations, whereas exploration develops new entrepreneurial ideas for future viability. Two emerging concepts in literature, complexity leadership and contextual ambidexterity, aim to enable simultaneous exploitation and exploration. Regardless of the similar objectives, available literature has not yet established an association between the concepts. Consequently, the first objective of this research investigated whether complexity leadership could promote an organisation's ability to enable both exploitative and exploratory innovation, simultaneously (contextual ambidexterity).

Additionally, both complexity leadership and contextual ambidexterity acknowledge the importance of the context within which organisations operate, and the accelerated rate of change in today's organisational environments (environmental dynamism). The rate of change would influence the effectiveness of leadership's innovation efforts. Accordingly, the second objective of this research hypothesised that environmental dynamism would moderate the relationship between these constructs.

A sample of 1 204 secondary survey responses was statistically analysed. The researcher confirmed that complexity leadership has a significant, positive, linear relationship with exploitation, exploration, and the combined construct contextual ambidexterity. However, the moderator effect of environmental dynamism on these relationships, was found not to be significant.

Therefore, complexity leadership promotes both exploitation and exploration, as well as contextual ambidexterity. This particular leadership approach creates the supportive context that promotes both types of innovation, simultaneously. Leadership can promote contextual ambidexterity through activities associated with this approach, including patterning of attention, developing networks, and contextual intelligence.

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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).

Environmental dynamism. “Refers to the rate of change and the degree of instability of the environment” (Jansen, van den Bosch & Volberda, 2006, p.8).

Moderator. “A moderator variable has been defined as one which systematically modifies either the form and/or strength of the relationship between a predictor and a criterion variable” (Sharma, Durand & Gur-Arie, 1981, p.291).

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.

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6 November 2017

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1. Introduction: Research problem and purpose

1.1. Introduction

Organisational literature reiterates that successful organisations are ambidextrous; aligned and efficient in the current context (exploitation), and adaptive to change in the environment (exploration) (Gibson & Birkinshaw, 2004). Organisations need to focus on their current successes, whilst also considering their long-term sustainability. Levinthal and March (1993, p.105) stated that organisations need "to engage in sufficient exploitation to ensure its current viability and, at the same time, to devote enough energy to exploration to ensure its future viability". Overall, the concept of organisational ambidexterity has been studied as a prerequisite for organisational success, survival (Raisch & Birkinshaw, 2008), and for remaining competitive (De Clercq, Thongpapanl & Dimov, 2014).

Furthermore, the importance of strategic leadership in pursuing both exploitation and exploration simultaneously (contextual ambidexterity), has often been highlighted (Jansen, Vera & Crossan, 2009). It is the responsibility of strategic leaders (decision makers) to ensure the organisation focuses on both timeframes. Despite recent increased interest, the specific means used by leaders to influence and stimulate organisational ambidexterity are still under-developed (Jansen et al., 2009). An improved understanding of the leadership behaviours that promote contextual ambidexterity could assist organisations in purposefully improving the effectiveness of their exploitation and exploration efforts.

There is an increased interest in the emerging leadership theory of complexity leadership (Dinh et al., 2014), as it is a leadership approach that enables an organisation to act more successfully within a dynamic environment (Clarke, 2013). Complexity leadership was conceptualised as the overarching framework of the operational (exploitive, administrative, alignment) and entrepreneurial (exploration, adaptive) system, and the adaptive space between these systems (Uhl-Bien & Arena, 2017).

In essence, both contextual ambidexterity, and complexity leadership aim to improve the organisation's navigation of its current and future contexts, to ensure both short and long-term successes. The first objective of this research aimed to establish that complexity leadership has an influence on exploitation, exploration and the combined concept of contextual ambidexterity. With this relationship established, leadership would be able to utilise complexity leadership behaviours to contextual ambidexterity.

In addition, leadership will also have to consider how external factors influence this relationship. One such potential external influence is environmental dynamism, as it has been shown to moderate the relationship between leadership styles, and exploitation and exploration innovation (Jansen et al., 2009). Environmental dynamism refers to the degree of instability and rate of change of the organisational environment (Dess & Beard, 1984); or how static or dynamic the environment is (Daft, 2016). The second objective of this research is to establish whether environmental dynamism has a moderating effect on the relationship between complexity leadership and contextual ambidexterity. This established the title of this research as: *Environmental dynamism as a moderator of the relationship between complexity leadership and contextual ambidexterity*.

The next section first describes the research problem addressed, and the purpose of this research. Thereafter it details the contribution it would make from a theoretical perspective, as well as its value for business. Finally, it introduces the remainder of the document with a description of the document purpose and structure.

1.2. Research problem

In the increasingly dynamic and complex business environment, organisations must be able to manage both exploitation and exploration innovation, seemingly disparate goals (Wu, & Wu, 2016). From this statement, it is clear that today's leaders face two challenges. Firstly, organisations and leadership find themselves in a changing context. As early as 1965, Emery and Trist (1965, p.21) stated that "The environmental contexts in which organisations exist are themselves changing, at an increasing rate, and towards increasing complexity".

Secondly, to remain successful in the long term, organisations and leadership, must implement both incremental change (exploitation), and revolutionary change (exploration) (Tushman & O'Reilly, 1996). The current operations need to be exploited, whilst future opportunities are explored. Exploitation focuses on refinement and extension of existing paradigms, competences, and technologies; whereas exploration is experimental in nature to discover new alternatives (March, 1991).

Exploitation, and exploration are intrinsically conflicting. The expectation of enabling and balancing both types of innovation simultaneously creates a 'strategic role conflict' (Floyd & Lane, 2000), as these expectations are at odds with each other (i.e. paradoxical) (Wu, & Wu, 2016). Exploitation has a short-term focus on efficient current operations, whereas exploration promotes long-term viability in a changing context. Overall, the goals that

exploitation and exploration aim to achieve are distinct and different (Lavie, Stettner & Tushman, 2010; Wu, & Wu, 2016). These concepts however remain interrelated and inseparable. A focus on either one individually could result in long-term failure (Tushman & O'Reilly, 1996).

The internal tensions and conflicts that result from this paradox need to be addressed (Raisch & Birkinshaw, 2008), and a balance must be struck between these types of innovations (Gibson & Birkinshaw, 2004). The optimal balance is however hard to determine (Levinthal & March, 1993), and achieving this balance is even more challenging in organisational systems that are traditionally grounded in bureaucracy, which values rationality, efficiency and stability (exploit), over the ability to adapt (explore) (Uhl-Bien & Arena, 2017). In essence, certain conventional management approaches could be appropriate for exploitative innovation, but inappropriate, and even detrimental, for explorative innovation (Danneels, 2002). Further, promoting both exploitation and exploration concurrently poses significant organisational challenges, which include, but are not limited to, increased complexity and coordination costs (De Clercq et al., 2014).

A systemic perspective of how organisations minimise the conflicts that arise from the paradoxical expectations is required (Floyd & Lane, 2000). Two emerging systems constructs, both aimed at managing this paradox while acknowledging the importance of the context, are complexity leadership and contextual ambidexterity. This research investigated the relationship between these constructs, building on the following facts:

- The increasingly dynamic and complex business environment calls for organisations to be able to manage both exploitation and exploration innovation (Wu, & Wu, 2016), the concept of contextual ambidexterity;
- Contextual ambidexterity emerges from features of the organisational context and allows simultaneous alignment (exploration) and adaptability (exploration) (Gibson & Birkinshaw, 2004);
- Complexity leadership is an overarching framework for leadership in a complex world (Uhl-Bien & Arena, 2017); and essentially seeks to enable and coordinate exploration and exploitation (Uhl-Bien, Marion & McKelvey, 2007).
- Environmental dynamism has been found to moderate the relationship between specific leadership types (transformation and transactional leadership), and exploitation and exploration innovation (Jansen et al., 2009).

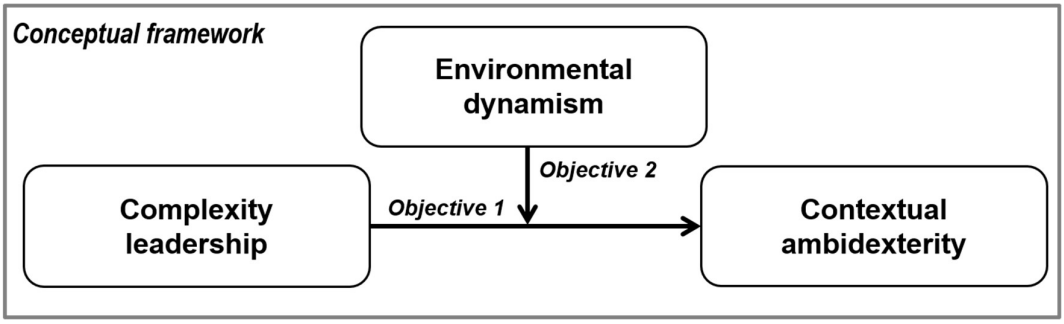
A deeper understanding of the relationship between complexity leadership and exploitation, and exploration, as well as the combined concept of contextual ambidextrity,

and the influencing factors on this relationship could be incorporated into leadership selection and development. This in turn, could enable leadership to manage the daily paradoxical requirements and improve the effectiveness of exploitation and exploration efforts.

1.3. Research purpose

The research aimed to investigate the moderating effect of environmental dynamism on the relationships between complexity leadership, exploitation, exploration and contextal ambidexterity. These constructs co-exist in the complex context of an organisation. Figure 1 below conceptualises the constructs and the relationships between these constructs, as well as the two main research objectives.

Figure 1 – Conceptualisation of research purpose



The scope of this research was limited to these constructs, as defined by literature, and the relationships between them. This research perspective was aligned with the overall movement in leadership research towards a systemic, and context relevant, perspective of business. Thus, this research would contribute to both theory and business.

1.3.1. Contribution to theory

Since the early 1970's, leadership behaviour research that aimed to identify or specify moderator variables has been popular (Howell, Dorfman & Kerr, 1986). Still, the impact of organisational context on leadership remains an under-researched area (Porter & McLaughlin, 2006). A systems perspective could assist in incorporating the context. The amount of scholarly research on systems leadership approaches, such as complexity leadership, has increased significantly recently (Dinh et al., 2014). Regrettably, there is a lack of theoretical and empirical knowledge on how complexity leadership shapes innovation (Mendes, Gomes, Marques-Quinteiro, Lind & Curral, 2016).

Simultaneous exploitative and exploratory innovation is crucial, that is, the concept of contextual ambidexterity. Jansen et al. (2009) recommended that future research on the

relationship between leadership and innovation should focus on the coexistence of exploitive and exploratory innovation as a collective (ambidexterity).

Havermans, Den Hartog, Keegan & Uhl-Bien (2015, pp.S180-S181) indicated that research is required "that takes the role of the context, specific leadership practices, and dynamics of leadership, into account in achieving ambidexterity". Over the past few years, the research interest on leadership-based antecedents of organisational ambidexterity has increased (Raisch & Birkinshaw, 2008). As an example, Nemanich and Vera (2009) established that transformational leadership is positively related to ambidexterity. The researcher could not find any evidence of empirical evidence of the relationship between complexity leadership and contextual ambidexterity.

Research by Jansen et al. (2009) confirmed that environmental dynamism moderates the relationship between specific leadership styles and organisational exploitive and exploratory innovation. The theoretical model tested by Jansen et al. (2009) is shown in Figure 31 in Appendix 1, along with an adapted summary of the findings of Jansen et al. (2009) in Figure 32. The role of environmental dynamism on the relationship between leadership styles and contextual ambidexterity has not been established. It is however recommended that future research of leadership should include specific focus on the nature of the organisational context, and not treat it as an afterthought (Porter & McLaughlin, 2006).

In conclusion, the three (3) main constructs under investigation are emerging perspectives in research. This research will contribute to theory as it combines these constructs in a new conceptual model, and investigates the relationships between these constructs.

1.3.2. Contribution to business

Leadership is facing changing organisational contexts. Uhl-Bien and Arena (2017, p.9) state that "in 2010, … the rising rate of complexity associated with increasing volatility, uncertainty and interconnectedness was the biggest challenge facing organisational leaders around the globe", and as a result "these contexts require adaptability and new ways of leading". Leadership does not occur in a vacuum, and its effectiveness is influenced by the context (Osborn, Hunt & Jauch, 2002; Hannah, Uhl-Bien, Avolio & Cavarretta, 2009). Understanding the organisational environment (context) could facilitate the improvement of leadership activities. This context is characterised by an increased pace in competition, tightening resource constraints, reduced product life cycles and blurred industry boundaries, with leaders experiencing increased pressure to

deploy existing competencies efficiently, while experimenting with new ones (Floyd & Lane, 2000).

Certain leaders will experience this complexity as exiting opportunities, for most, however, the lack of clarity and the speed of complexity feels increasingly overwhelming and chaotic (Uhl-Bien & Arena, 2017). Leaders need appropriate approaches to navigate these complexities. Given this need, leadership theories are moving toward a more systemic perspective of leadership (Clarke, 2013), with emerging theories such as complexity leadership. These theories model the reality to assist in simplifying the issues and possible solutions.

The importance of strategic leadership in pursuing simultaneous exploitation and exploration (ambidexterity) has been highlighted frequently (Jansen et al., 2009). Raisch and Birkinshaw (2008, p.394) propose that, due to the increasing environmental hostility, “organisational ambidexterity may be more of a necessity than a differentiating factor”. Thus, it is expected of leaders to simultaneously manage both exploration and exploitation, within a complex context. This creates a ‘strategic role conflict’, which could cause further distress for the leader (Floyd & Lane, 2000).

Business leaders could significantly benefit from understanding how a complexity leadership approach creates the space for managing these paradoxical innovation requirements, and thus, how it relates to managing contextual ambidexterity. A recognised leadership approach, that enables management of the paradoxical requirements, could serve to reduce the distress experienced and improve the potential effectiveness of simultaneous exploitation and exploration. This is required urgently, as the ability to manage both exploitation and exploration is essential for organisations to thrive in the increasingly dynamic and complex environment (Wu & Wu, 2016).

Moreover, leaders can benefit from understanding the influence of external factors, such as environmental dynamism, on this relationship. Organisations operate in a certain context, an aspect both complexity leadership and contextual ambidexterity acknowledge. Osborn et al. (2002, p.797) state that “leadership and its effectiveness, in large part, is dependent upon the context”. Thus, leadership is contextualised (Hannah et al., 2009). Leadership must be cognisant of how the context influences exploitation and exploration efforts, with a thorough comprehension of the stability or shifting nature of the organisational task environment.

1.4. Document purpose and structure

The research aimed to investigate the moderating effect of environmental dynamism on the relationships between complexity leadership and exploitation, exploration and contextual ambidexterity. This chapter provides an introduction to the research problem. The remainer of the document is strucutred as follows:

- Chapter 2: A thorough review of available academic literature to describe the key constructs identified, and the relationships between the constructs;
- Chapter 3: The research objective and hypothesised relationships, as deduced from the literature reviewed;
- Chapter 4: The research methodology followed, 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 during the quantative data analysis;
- Chapter 6: A discussion on the results obtained as they relate to the literature reviewed and the hypothesised relationships;
- Chapter 7: A conclusion of findings from the research, their implications for business, and limitations, with recommendations for future research.

2. Theory and literature review

Chapter 1 described the need for an organisation to be ambidextrous, and how both contextual ambidexterity, and complexity leadership aim to improve the organisation's navigation of its current and future contexts, to ensure both short-term and long-term successes. This chapter, with the supporting appendices (Appendix 1 and Appendix 2), provide a review of the relevant literature. First, each construct is described; thereafter the relationships between these constructs are deduced.

2.1. Identified constructs

From the research title, *environmental dynamism as a moderator of the relationship between complexity leadership and contextual ambidexterity*, the core constructs identified were:

- Contextual ambidexterity, as a combined construct of simultatneous exploitative and exploratory innovation;
- Complexity leadership, as a construct of patterning of attention, developing networks, and contextual intelligence;
- Environmental dynamism as a moderator of the relationship between complexity leadership and contextual ambidexterity.

This chapter, and the corresponding Appendix 2, provide a review of the relevant literature. Each of the constructs are described and thereafter, the relationships between these constructs are deduced.

2.2. Contextual ambidexterity

It is expected of management to simultaneously run current operations efficiently, whilst searching for future opportunities – the concept of innovation. This section highlights the need for organisational innovation; describes exploitative and explorative innovation; how ambidextrous organisations enable exploitation and exploration, traditionally through structural separation; and the emerging requirement for business to be able to implement both simultaneously – known as contextual ambidexterity.

2.2.1. Organisational innovation

Mendes et al. (2016, p.302) state that "twenty-first-century organizations [*sic*] deal with the pressure to be innovative". Innovation refers to the intentional implementation of new and better ways of doing things (West & Rickards, 1999). Technological innovation in organisations can either be incremental or radical innovation. Incremental innovation refers to slight adaptations of existing products, processes and business approaches,

whereas radical innovation represents fundamental changes, which lead to a complete change of products or approaches (Raisch & Birkinshaw, 2008). Incremental innovation is related to the exploitation of current organisational capabilities, and radical innovation is related to the exploration of future opportunities; concepts introduced to organisational literature by March (1991).

2.2.2. Exploitation and exploration innovation

The increasingly dynamic and complex business environment calls for organisations to be able to manage both exploitation and exploration innovation (Wu, & Wu, 2016). Both exploitation and exploration innovation contribute to business success. Yet, the goals that each aims to achieve are distinct and different (Lavie et al., 2010; Wu, & Wu, 2016). For this reason, it is crucial to differentiate between these two different types of innovation. The differences, as described in literature, are summarised in Table 1 below.

Table 1 – Characteristics of exploitation and exploration innovation

Characteristics of exploitation and exploration innovation		
Exploitation	Goal of alignment	Stability, that could lead to inertia (Lavie et al., 2010).
	Incremental technological innovation	Describes incremental innovations to ensure existing customers' needs are met (Raisch & Birkinshaw, 2008).
	Focus on existing	Focuses on refining and extending existing paradigms (March, 1991).
	Efficiency activities	Associated with activities of refinement, selection, efficiency, and implementation (Raisch & Birkinshaw, 2008).
	Current, controlled perspective	Current viability of the organisation (Levinthal & March, 1993), achieved through control (Wu, & Wu, 2016).
	Organisational adaption	Emphasize alignment and exploitation during periods of evolutionary change (Tushman & Romanelli, 1985).
	Top-down communication	Top-down knowledge, flows down from persons at higher hierarchical levels (Raisch & Birkinshaw, 2008).
	Experiential learning	Learning gained through internal search, experiential refinement, based on existing routines (Raisch & Birkinshaw, 2008).
Exploration	Goal of adaptability	Flexibility and adaption as required (Lavie et al., 2010).
	Radical technological innovation	Explorative innovation is radical in nature, designed to meet the needs of emergent or new customers (Raisch & Birkinshaw, 2008).

	Focus on new alternatives	Focuses on competences, and technologies; and is experimental in nature, discovering new alternatives (March, 1991).
	Experimentation activities	Associated with search, variation, experimentation, and discovery activities (Raisch & Birkinshaw, 2008).
	Future, autonomous perspective	Future viability of organisation (Levinthal & March, 1993), achieved through autonomy (Wu, & Wu, 2016).
	Organisational adaption	Emphasis on radical exploration and transformation in periods of revolutionary change (Tushman & Romanelli, 1985).
	Bottom-up communication	Knowledge flows bottom-up and horizontal, from persons on the same, or lower hierarchical levels (Raisch & Birkinshaw, 2008).
	Experimental learning	Learning gained through planned experimentation and “play” (Raisch & Birkinshaw, 2008).

Even with the difference acknowledged, the relationship between exploitation and exploration innovation is complex:

- Contradictions exist between exploitation and exploration, and organisations have to reconcile the internal tensions and conflicting demands that result (Raisch & Birkinshaw, 2008).
- Certain conventional management approaches could be appropriate for exploitative innovation, but inappropriate, and even detrimental, for explorative innovation (Danneels, 2002).
- Promoting both exploitation and exploration concurrently poses significant organisational challenges, which include, but are not limited to, increased complexity and coordination costs (De Clercq et al., 2014).
- Exploitation and exploration are interrelated (De Clercq et al., 2014), and even considered inseparable (Floyd & Lane, 2000).
- Focusing solely on exploration reduces the returns on internal knowledge, whereas focusing on exploitation solely increases the risk of obsolescence (Levinthal & March, 1993). Conceptually, a focus on either one of these skill sets individually is straightforward, but could result in long-term failure (Tushman & O’Reilly, 1996).
- Organisations need to have the correct balance between exploitation and exploration (Gibson & Birkinshaw, 2004); yet determining the appropriate balance is complicated (Levinthal & March, 1993).

Overall, the need for both exploitative and explorative innovation, and the complex paradoxical relationship that exists between them, poses a perplexing challenge for

business leaders. In complex environments, organisations require mechanisms and processes to support and promote both stability (exploitation of the current environment) and change (exploration of the environment) (Mendes et al., 2016), which however, is not easy to achieve (Nemanich & Vera, 2009). Understandably, literature shows an increased interest in balancing different types of innovation, along with the concept of organisational ambidexterity (Benner & Tushman, 2015).

2.2.3. Ambidexterity

It has been proven possible to balance these paradoxical innovation requirements. Organisations that successfully coordinate the development of both exploitive and exploratory innovation are called ambidextrous (Jansen et al., 2006). Ambidexterity was described by Tushman and O'Reilly (1996, p.11) as the "ability to simultaneously pursue both incremental and discontinuous innovation". In essence, the ambidextrous organisation efficiently aligns its current operations to what is required, while simultaneously effectively adapting to the changing environmental demands (De Clercq et al., 2014; Gibson & Birkinshaw, 2004; Tushman & O'Reilly, 1996). Since its inception, organisational ambidexterity has been studied as a prerequisite of organisational survival and success (Raisch & Birkinshaw, 2008). De Clercq et al. (2014) states that "to remain competitive, firms must be ambidextrous".

According to Gibson and Birkinshaw (2004) the term Organisational Ambidexterity was first used by Duncan (1972) in "The ambidextrous organization [*sic*]: Designing dual structures for innovation". It suggested the conflicting demands placed on management could be dealt with by implementing "dual structures"; one group focusing on alignment, and the other on adaption. Literature on organisational ambidexterity come from different streams, including technological innovation, organisational learning, strategic management, and organisational design and adaptation (Raisch & Birkinshaw, 2008).

Organisational ambidexterity is progressively developing into a new research paradigm within organisational theory (Raisch & Birkinshaw, 2008). This research incorporates both the nature of ambidexterity antecedents (structures, processes, or behaviours), and how it relates to different levels (environmental, organisational, and people) (Asif, 2017).

Carter (2015) described a hierarchy of organisational ambidexterity capabilities (zero-order, first-order and second-order ambidexterity), and articulated that only by establishing a fully-integrated system, will sustainable ambidexterity by achieved. The ambidexterity types are summarised in Table 2. For this reason, this research refers to the holistic, systems approach to ambidexterity.

Table 2 – Types of organisational ambidexterity, adapted from Carter (2015)

Type of ambidexterity	Focus	Aspects	Requirement
Zero-order	Executing a strategy of simultaneous exploitation and exploration.	Managed paradox.	Mechanisms to support both exploitation and exploration.
First-order	Dynamically shifting the strategic content (or ratio of exploitation and exploration); and the organisational context, to support the new strategy.	Dynamic capabilities for strategic and organisational realignment.	Specialised resources, with high continuity and fluidity.
Second-order	Dynamically shifting the dominant logic of top leadership to adapt thinking, behaviour, and processes to orchestrate the ambidextrous organisational system.	Paradoxical cognition, and leadership complexity.	Long-tenured and highly talented top leadership.

The doctrine of ambidexterity remains sound, in the face of certain fundamental changes in innovation in the past decade (Benner & Tushman, 2015). New literature keeps coming to light as scholars remain curious about organisational ambidexterity.

2.2.4. Contextual ambidexterity

Duncan (1976) originally framed ambidexterity in terms of structures, stating “dual structures” need to be established. Furthermore, he confirmed that conflicting demands require trade-offs (Gibson & Birkinshaw, 2004; Lavie et al., 2010), and offered organisational separation as a solution to the balance dilemma (Lavie et al., 2010). Gibson and Birkinshaw (2004) labelled this “structural ambidexterity”.

Structurally ambidextrous organisations have highly differentiated units (Lavie et al., 2010), formally separated. Each unit pursues different strategies, which is achieved through varied structures, and cultures (Tushman & O’Reilly, 1996), and match the specific needs of its task environment (Gibson & Birkinshaw, 2004). The premise is that giving each business unit a specific focus (either exploitation or exploration), establishes specific focus, and equips to business to address both.

The role that processes and systems play in achieving a balance between opposing demands, within a challenging context, is receiving growing recognition (Gibson & Birkinshaw, 2004). A systems perspective views an organisation as one whole, which would require an integrated approach to both types of innovation. For this reason,

scholars have recently shifted their interest toward the importance of simultaneously balancing the contradicting tension, a paradoxical perspective (Gibson & Birkinshaw, 2004). From this, Gibson and Birkinshaw (2004) developed a concept of Contextual Ambidexterity.

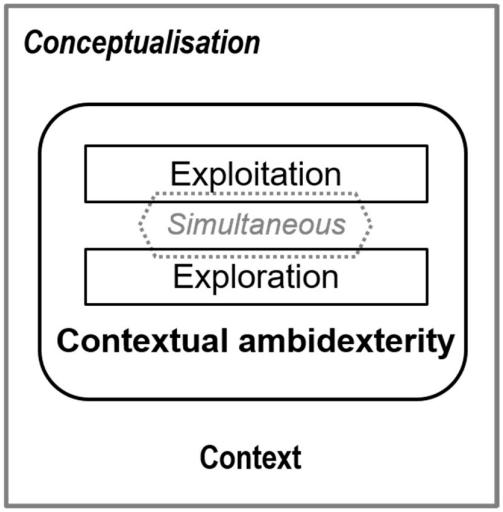
Gibson and Birkinshaw (2004) defined contextual ambidexterity as "the behavioural capacity to simultaneously demonstrate alignment and adaptability across an entire business unit". It is best achieved, not by implementing dual structures (the concept of structural ambidexterity), but by purposefully building systems and processes that enable, and intrinsically encourage individual employees, to manage the conflicting demands (Gibson & Birkinshaw, 2004). Contextual ambidexterity indicates the presence of system capacities aimed at both types of innovation, throughout the organisation (De Clercq et al., 2014). In essence, contextual ambidexterity emphasises the development of processes and systems (Asif, 2017).

According to Gibson and Birkinshaw (2004, p.210) these systems collectively establish a context that allows the meta-capabilities of alignment and adaptability to co-exist simultaneously. In essence, the presence of both alignment and adaptability is contextual (De Clercq et al., 2014), and present at all the levels of the organisation. The organisation as a whole should be equipped to collectively innovate, with the ability to comprehend its context.

2.2.5. Conceptualisation of contextual ambidexterity

Lavie et al. (2010) conceptualised the context, conduct and performance of exploration and exploitation, attempting to understand the modes of coping with the paradoxical requirements, shown in Figure 33 in Appendix 1. From this conceptualisation, and the literature reviewed, the researcher conceptualises contextual ambidexterity as shown in Figure 2. Contextual ambidexterity is achieved when organisational systems and processes allow for simultaneous exploitation and exploration, and the tensions between these two elements, are coordinated and balanced. It occurs in a given organisational context, with which it directly interacts.

Figure 2 – Conceptualisation of Contextual Ambidexterity



2.3. Complexity Leadership

Establishing the appropriate balance between exploitation and exploration poses unique challenges for leadership (Uhl-Bien et al., 2007). Leaders are expected to address these challenges in an increasingly complex context. For this reason, there has been a growing sense that leadership literature does not yet fully explain the leadership dynamic of the new knowledge-driven economy (Avolio, Walumbwa & Weber, 2009); giving limited value to the complexity of this context (Clarke, 2013). Focus should be placed on leadership approaches that acknowledge these complexities, and provide practical solutions to these challenges.

In this section, the theoretical foundation of complexity leadership is reviewed. It describes general systems theory as the basis for complexity theory, followed by an argument for why leadership theories are developing toward a more systemic perspective. Thereafter complexity leadership theory is explained, as well as the important concept of complex adaptive systems, the leadership types within complexity leadership, and finally the leadership behaviours that enable an adaptive space.

2.3.1. Systems and complexity theory

General systems theory

According to von Bertalanffy (1972, p.407), Aristotle's statement of "the whole is more than the sum of its parts" still defines basic system problems. From this, von Bertalanffy (1972) formulated General Systems Theory, that serves as a model of certain aspects of reality (von Bertalanffy, 1972). The complex relationships between parts within a system are acknowledged and approached as a whole (Ackoff, 1971). Organisations can

be viewed as systems, and even if a part each of the organisation reaches its objectives, the organisation might not perform against its objectives (Ackoff, 1971).

This systems perspective of organisations could be valuable for leadership, as leadership goes beyond a leader and follower, and includes the influence of leaders in and around the system it occurs in (Osborn et al., 2002).

Complexity theory

Complexity theory has historical roots, but became a movement in the mid-1980's, after the formation of the Santa Fe Institute (Pascale, 1999; Schneider & Somers, 2006). It considers how principles from the physical and biological sciences can inform our understanding of adaptability in an organisational context (Uhl-Bien & Arena, 2017). It allows for a new conceptualisation of organisational structures and leadership (Schneider & Somers, 2006), and an understanding of how leadership allow adaptability of a system.

Complexity is present inside the organisation, as well as in its context (Anderson, 1999), and it captures the dramatic change occurring in social systems (Schneider & Somers, 2006). It provides guidance to how leadership on how to navigate the changes internally and externally, and how to promote the appropriate adaption. Complexity leadership theory was developed by directly applying the concepts of complexity theory to the study of leadership (Avolio et al., 2009). A few complexity theory terms that are used in this document are defined in Table 32 in Appendix 2.

2.3.2. Development of systems thematic category of leadership theories

Previously, theories of leadership have often been regarded as a one-on-one relationship (e.g. leaders-member exchange theory), a psychological trait (e.g. charismatic leadership), or as being collective-orientated or self-orientated (e.g. shared leadership or self-leadership) (Mendes et al., 2016). Overall, leadership research has been, until relatively recently, dominated by so called "soloheroic" leadership models, characterised by style theories of leadership (Clarke, 2013).

However, viewing the simple exchange between leader and follower does not fully explain the dynamics of leadership (Avolio et al., 2009). The scholarly interest on this topic of leadership has increased over the last decade, and a diverse group of leadership theories are developing (Dinh et al., 2014). Overall, leadership theories are moving toward a more systemic perspective of leadership (Clarke, 2013), and are starting to appreciate the social context in which the leader operates (Dinh et al., 2014; Hannah et

al., 2009; Osborn et al., 2002). This is essential as Hannah et al. (2009, p.897) states that “leadership is uniquely contextualized [*sic*]”.

The amount of research on the emerging systems thematic category of leadership theories outnumbers that of other emerging leadership approaches (Dinh et al., 2014). The leadership theories in the systems thematic category includes social network, contextual, integrative and complexity approaches, each capturing aspects of contextual features (Dinh et al., 2014). Incorporating aspects of the complex context within which leadership occurs, increases the practical value of these approaches.

Schneider and Somers (2006) confirmed that leadership theories that evolved from general systems theory are still applicable in many contexts, and emerging complexity theory models of leadership show great potential. These emerging leadership theories are based on the concept of complexity, a central construct in the terminology of organisation scientists (Anderson, 1999).

2.3.3. Complexity leadership theory

Clarke (2013, p.135) states that “the term complexity captures the greater levels of uncertainty, ambiguity, interdependencies and interrelatedness that now characterize the environments in which organizations [*sic*] operate”. Insights from complexity science provide the perspective of leadership as a property of a larger social system (Clarke, 2013). The theory of Complexity Leadership moves beyond the past managerial logics, and offers a new way of perceiving leadership as a theoretical framework, that meets the new leadership requirements of the knowledge-driven economy (Uhl-Bien et al., 2007).

Uhl-Bien and Arena (2017) stated that “complexity is about rich interconnectivity” (p.9), and “it takes complexity to beat complexity” (p.10). Complexity leadership theory acknowledges that leadership will need to lead in new ways, to address the complexity in organisational contexts. It offers adaptive responses to rapidly changing and complex problems through network-based problem solving (Uhl-Bien et al., 2007).

Complexity theory, however, still acknowledges that the adaptive system is established within organisations grounded in bureaucracy and daily operations. The theory attempts to integrate the adaptive nature of complexity dynamics, with the controlled bureaucratic nature of an organisation (Uhl-Bien et al., 2007). Uhl-Bien et al. (2007, p.304) confirmed this by stating that “it seeks to integrate… enabling and coordinating, exploration and exploitation”.

Uhl-Bien et al. (2007, p.314) viewed leadership as a "complex interactive dynamic through which adaptive outcome emerge". Mendes et al. (2016) explain that it regards leadership as a shared emergent process, attributed to both individuals and teams, that established a capacity to be adaptive. Thus, complexity leadership changes the leader's role to that of an enabler, rather than controller, of the organisation's future (Dinh et al., 2014). A complexity leadership model identifies and explores how to leverage the dynamic capabilities of complex adaptive systems, to foster organisational creativity, learning, and adaptability (innovation) (Uhl-Bien et al., 2007). Thus, complex leadership's objective is to understand how leadership can establish an innovation enabling system.

Complexity leadership and theory

From a theoretical perspective, the complexity leadership approach added to leadership research by considering mechanisms and contexts by which change is facilitated, and systems elaborate (Uhl-Bien et al., 2007). The literature on the topic of complexity leadership theory is growing (Mendes et al., 2016), although empirical research is in its infancy (Clarke, 2013). There is a growing interest in leadership theories that incorporate the organisational context, as context is central to the emergence and manifestation of leadership activities (Dinh et al., 2014).

Complexity leadership and business

From a business perspective, complexity leadership can contribute to organisational success. Complexity leadership links complexity theory, and organisations conceptualised as complex adaptive systems, to how leaders can be successful in turbulent environments (Dinh et al., 2014). As a result, it allows an organisation to deal more successfully with the dynamics of its context (Clarke, 2013). Leaders adopting this approach could promote organisational success.

2.3.4. Complex adaptive systems

Systems are often complex, but not necessarily adaptive (Pascale, 1999) as they can be rigid and unable to change as required. Organisations, however, no longer experience the deterministic cause and effect, and equilibrium conditions traditional strategy concepts assumed (Pascale, 1999). For this reason, a new doctrine based on Complexity theory developed, referred to as Complex Adaptive Systems (CAS) (Schneider & Somers, 2006).

Traditional leadership theory views the leader, and the follower(s), as the unit of analysis (Avolio et al., 2009). The complex adaptive system is the basic unit of analysis in complexity science (Uhl-Bien et al., 2007), and complexity leadership (Avolio et al.,

2009). This perspective has enabled great progress in research as it allows for analysis of how the living world actually works (Pascale, 1999). Where traditional leadership perspectives would only consider the influence a leader has on follower(s), complexity leadership considers the influence the leader has on the outcomes of the whole organisational system.

Pascale (1999, p.83) states that "treating organisations as complex adaptive systems provides powerful insights into the nature of strategic work". Organisations can be viewed as complex adaptive systems (Schneider & Somers, 2006), that are dynamic, with no centralised control or fixed order (Uhl-Bien & Arena, 2017). The adaptive system is self-organising, and as a result, is able to adapt in, and even evolve with a changing context (Uhl-Bien & Arena, 2017). Applying complex adaptive systems concepts in strategic management highlights the requirement to build organisational systems that have the ability to rapidly evolve, effectively, adaptive solutions (Anderson, 1999).

Complex adaptive system characteristics

For a system to be classified as a complex adaptive system, it must exhibit the following four characteristics (Pascale, 1999, p.84):

- Comprised of many agents, not arranged in a hierarchical control;
- Continuously shift its building blocks as to rearrange levels of structure and organisation;
- Exhibits entropy, winding down over time if energy is not purposefully replenished;
- Capacity for pattern recognition and anticipation of future, to recognise change.

From these characteristics, it can be seen that an organisation can be viewed as a complex adaptive system. Even though all organisations have a level of bureaucracy and hierarchical control, complex adaptive systems recognise the informal networks that are established between agents within the organisation. Thus, complex adaptive systems describe an organisation as a collection of interconnected networks and agents (Uhl-Bien & Arena, 2017), with the ability to recognise patterns, rearrange, and adapt. This perspective of organisations could assist leadership in enabling the appropriate organisational adaptability.

2.3.5. Complexity leadership: Leadership types

Researchers are increasingly recognising the importance of balancing seemingly contradictory tensions (Raisch & Birkinshaw, 2008). In light of this, complexity leadership acknowledges that an organisation needs to enable the operational and the entrepreneurial systems simultaneously. It focuses on the multifaceted and interactive dynamics of complex adaptive systems and how individuals enable adaptive outcomes in this context (Uhl-Bien et al., 2007). It explains how a complex adaptive system would operate in a typical bureaucratic organisation (Avolio et al., 2009). For this, the framework incorporates three (3) different types of leaderships:

Operational leadership

The operational leadership is administrative and grounded in the traditional, bureaucratic approach of hierarchy, control and alignment (Uhl-Bien et al., 2007). This leader's key role is to convert emergent ideas into ongoing results through alignment and execution. That is, to implement the new idea or approach as to enhance organisational performance and fitness (Uhl-Bien & Arena, 2017).

Entrepreneurial leadership

Entrepreneurial leadership is adaptive. It is a generative dynamic that allows emergent change (Uhl-Bien et al., 2007). This leader's key role is the creation and development of novelty (ideas, innovative solutions, new product, etc.). That is, to capitalise on opportunities, and adapt the organisation (Uhl-Bien & Arena, 2017).

Enabling leadership

The enabling leader structures the organisation and enables conditions that promote complex adaptive system dynamics, allowing optimal creative problem solving, learning and adaptability (Uhl-Bien et al., 2007). The enabling leader's key role is to operate in the interface between the operational and entrepreneurial system (Uhl-Bien & Arena, 2017). Open channels are required between these two systems to allow for interaction and connection (Uhl-Bien & Arena, 2017). This leader should nurture and enable an adaptive space, that in turn encourages emergence for adaptive responses (innovation).

In essence, this leader minimises the constraints of bureaucracy, to enhance the organisation's potential (Avolio et al., 2009). Promoting adaptive space should be encouraged and leaders should be equipped with the appropriate knowledge of complex adaptive systems. Uhl-Bien and Arena (2017, p.16) state that "developing and rewarding enabling leadership practices is critical for organisational success and survival in today's complex world".

2.3.6. Leadership behaviour

The enabling leadership establishes the adaptive space to address the tension that exists between the entrepreneurial (informal) system, and the operational (formal) system (Uhl-Bien & Arena, 2017). Within this space the agents interact, changing one another in unexpected, and irreversible ways (Uhl-Bien & Arena, 2017). The agents within the system, including the leader, interact, which results in novel outcomes. These interactions cannot be managed in the traditional manner. Instead, leaders need to enable adaptive responses by engaging in and creating conditions that encourage emergence (Uhl-Bien & Arena, 2017). Thus, leadership must enable innovative interactions between the interconnected agents within an organisational system.

Essentially, the adaptive space opens up information flows and engagement between these systems, to enable the emergence of novelty and innovation required for adaptability (Uhl-Bien & Arena, 2017). Aligned to this statement are three important complexity leadership behaviours (sub-constructs) that enable an adaptive space (Clarke, 2013); patterning of attention (information flow), developing networks, and contextual intelligence (meaning making).

Patterning of attention

Osborn et al. (2002, p.813) state that “one key neglected aspect of leadership is the willingness and ability of leaders individually and collectively to specify what is important and what information is relevant to moving toward desirable ends”. Patterning of attention involves the open dialogue and discussion, facilitated by leadership, on what is important, rather than what needs to be done or how to do it (Osborn & Marion, 2009). It prioritises information and creates focus and cohesion among strategic initiatives, and thus increases the likelihood of their success (Osborn et al., 2002). This improved information flow results in greater interconnectivity and redistribution of power, which allows for unprecedented change (Uhl-Bien & Arena, 2017).

As a construct, patterning of attention is associated with contextual leadership (Osborn & Marion, 2009). The leader facilitates knowledge co-creation within the adaptive space, that establishes system processes associated with adaptation and innovation (Clarke, 2013). In summary, patterning of attention allows both types of innovations to emerge from within the organisation.

Developing networks

Changing information technology and globalisation have made it evident that organisations do not operate in a vacuum as independent bureaucratic entities (Osborn et al., 2002). Organisations are part of unique networks, both internally and externally (through supplier relationships and partnerships). Osborn et al. (2002) described that an organisation has a choice to which network it belongs, its network memberships, and how these networks are linked. Thus, leaders need to develop effective networks, both externally and internally.

Scholars have developed theories to explain the role of the leader in complex systems, which include the management of dynamic social networks (Dinh et al., 2014). Developing networks are associated with network leadership (Osborn et al., 2002), a leadership approach that forms part of the systems thematic category of research (Dinh et al., 2014). Network leadership focuses on the development and maintenance of interpersonal ties within and outside, as well as up and across, the system (Osborn et al., 2002).

Given its importance to enable adaptive space, complexity leadership incorporates network leadership. Leaders are embedded in these dynamically changing networks, and should develop the network to enable adaptive responses through the correct contexts and patterns of behaviour (Uhl-Bien et al., 2007). Thus, the concept of developing networks within adaptive spaces goes beyond the leader's personal ability to establish social networks. It incorporates the ability to establish the differentiated neural-like networks that connect the complex adaptive systems agents (Uhl-Bien et al., 2007) in such a way to allow for innovation. These connections are not the traditional hierarchical structures. In complex environments, instead of hierarchical order and control, adaptive responses are required, that resist the pull to order and capitalise on the collective intelligence of groups by engaging networks and emergence (Uhl-Bien & Arena, 2017).

Contextual intelligence

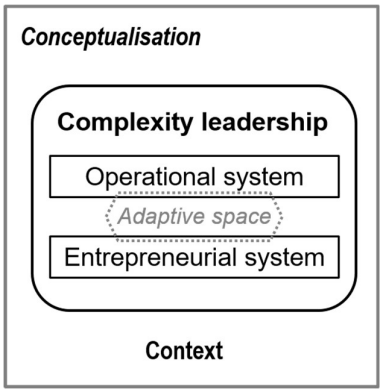
Contextual intelligence is the ability to recognise and diagnose a large number of contextual factors (Kutz, 2008). It builds on the fact that today's leaders need to be able to foresee and diagnose various contexts, and quickly and seamlessly adapt (Kutz, 2008). A leader with strong contextual intelligence will be able recognise and interpret the current contexts, and use this new knowledge to exert influence to position for a preferred future (Kutz, 2008).

It involves the convergence of three "soft" leadership capabilities: an intuitive understanding of historic events, an acute awareness of the relevant present contextual variables, as well as an understanding of a preferred future (Kutz, 2008). The leader then shares this knowledge to establish a shared understanding across the system (Clarke, 2013). Complex adaptive systems also inherently have the capacity for pattern recognition and learning, in order to anticipate the future, and adapt (Pascale, 1999). This intelligence and shared knowledge forms the basis for new innovative ideas.

2.3.7. Conceptualisation of complexity leadership

Uhl-Bien and Arena (2017) conceptualised complexity leadership as the overarching framework of the operational (exploitive, administrative, alignment) and entrepreneurial (exploration, adaptive) system, and the adaptive space between these systems. From this conceptualisation, and the literature reviewed, the researcher conceptualised complexity leadership as shown in Figure 3 below. Complexity leadership enables the entrepreneurial and operational system to exist simultaneously, with an adaptive space enabled between these systems. This complexity leadership occurs in a given organisational context, with which it directly interacts.

Figure 3 – Conceptualisation of Complexity Leadership



2.4. Environmental dynamism

A comprehensive understanding of organisational behaviour requires knowledge on the exchanges between the organisation and its environment (Emery & Trist, 1965). Organisations operate within a context (environment) and leaders must be cognisant of how this affects their leadership efforts.

Cummings and Worley (2015, p.786) define the environment as "the physical and social context within which any client system (a person, group, or organisation) is functioning". It is everything outside of the system (external forces), that influences the system and

can, either directly or indirectly affect its outputs (Cummings & Worley, 2015). There are three types of environments that influence how an organisation functions (Cummings & Worley, 2015), described in Table 33 in Appendix 2. This research focuses on the task environment, which is predominantly defined as the industry level pressures the organisation faces (Cummings & Worley, 2015).

This section reviews the literature on the organisational task environment, and details the dimensions organisational theorists defined to improve the understanding of complex environments. Of these dimensions, the 'dynamic' dimension influences decision making most significantly – a construct known as environmental dynamism.

2.4.1. Organisational task environment

The task environment focuses on the external stimuli to which an organisation is exposed and responds to, which is relevant for goal setting and attainment (Dill, 1958). Essentially, the task environment includes only the elements with which the organisation interacts directly (Daft, 2016). The organisation exchanges information and resources with its environment (Cummings & Worley, 2015), which establishes transactional interdependencies (Emery & Trist, 1965). This direct interaction determines its success to a large extent.

Systems perspective of task environment

As early as the 1960's scholars recognised the system-connectedness between an organisation and its environment. This connectedness is of great importance to an organisation, and it could alter its responses (Emery & Trist, 1965). The complexity is increased by the fact that both the organisation and its environment are filled with variables, which are known to be difficult to predict or control (Jain, 2005). These variables are crucial, as decision makers must analyse a variety of environmental factors including the complexity, routineness or non-routineness of a problem-opportunity, the presence of organised or unorganised sectors, and whether such sectors directly or indirectly relate to the organisation (Jurkovich, 1974).

2.4.2. Environmental dimensions

Organisational task environments are different for each organisation on points such as: degree of unity and homogeneity, degree of stability, the disruptiveness of certain environmental inputs, demands for direct and personal interaction, and the complexity and routing of inputs (Dill, 1958). From the early theories, such as Dill (1958), it is evident that organisational environments are unique and complex.

Organisational theorists subsequently developed dimensions to allow for classification and comprehension of organisational environments. Duncan (1972) summarises the work done by scholars such as Emery and Trist (1965), Thompson (1967) and Terreberry (1968), by defining two environmental dimensions: static-dynamic and simple-complex. Volberda and Van Bruggen (1997) later confirmed these dimensions as a definition of environmental turbulence, but further added a predictable-unpredictable dimension.

Simple-complex dimension

Terreberry (1968, p.593) states that "turbulence is characterized [*sic*] by complexity". Certain organisations are fortunate to operate in task environments with a certain degree of unity and homogeneity (Dill, 1958). The degree to which the environment is homogeneous is however, not absolute. That is, all organisations face a task environment that can be defined on a homogeneous-heterogeneous or simple-complex, continuum (Thompson, 1967). This simple-complex dimension describes the number of factors considered by the organisation during decision making (Duncan, 1972), with complexity increasing the number of variables leaders need to consider.

Static-dynamic dimension

Independent from the simple-complex dimension, an organisation task environment can also be defined by a stable-shifting or static-dynamic continuum (Thompson, 1967). This dimension relates to the accelerated rate of change in organisational environments (Terreberry, 1968). It defines the rate at which the variables considered by leaders change over time. Thus, the static-dynamic dimension describes the degree to which these environmental factors are static and remain constant, or are dynamic and in a constant process of change (Duncan, 1972).

Of all four of the dimensions, Duncan (1972) identifies the dynamic dimension as the most prominent. Individuals in organisations with dynamic environments experience a higher level of uncertainty during decision making (Duncan, 1972). Thus, environmental variables in constant state of change increase the uncertainty faced by the organisation's leaders.

2.4.3. Environmental dynamism

The static-dynamic dimension, as defined by Duncan (1972), can also be referred to as the environmental dynamism (Daft, 2016; Volberda & van Bruggen, 1997). Environmental dynamism refers to how stable or unstable (turbulent) the environment is (Daft, 2016; Dess & Beard, 1984; Jain, 2005). Sidhu, Volberda and Commandeur (2004, p.918) state that "much of organization [*sic*] theory on environment concentrates on its

dynamism feature".

Environmental dynamism is measured by turnover, absence of pattern, and unpredictability in the environment, and focuses on environmental change that is hard to predict, which increases uncertainty (Dess & Beard, 1984). Daft (2016) stresses that all organisations face tremendous uncertainty as a result of the external environment, and often have to adapt relatively quickly. Thus, environmental change is an important determinant of internal behaviour as organisations attempt to diagnose external uncertainties and internal change rates (Jurkovich, 1974).

It is crucial to differentiate between the rate of environmental change (frequency) and the intensity of the changes occurring (Volberda & van Bruggen, 1997). Organisations have to be able to adapt to both small, subtle and large substantial shifts in the environment (Daft, 2016), and the need for the ability to respond quickly and flexibly is increasing (Jain, 2005).

Environment changes can occur in different parts of the organisational task environment, such as the product or factor markets, each with different implications (Floyd & Lane, 2000). Jain (2005, p.398) states that "dynamism also relates to the need for speed in responding to customers' and other stockholder's demands". Consumer interests can change, or there can be significant changes in the industry, such as new competition, economic turmoil or innovative technologies (Daft, 2016). Leaders must be cognisant of changes in the task environment, to ensure appropriate responses. As a result, the dynamism of the external environment has a major impact on organisational design and management action (Daft, 2016).

2.5. Relationships between complexity leadership and exploitation, exploration, and contextual ambidexterity, and environmental dynamism

Studies have investigated certain promoters of ambidexterity, and the complex interrelations of how moderators, such as environmental factors, affect relationships between antecedents and elements of ambidexterity (Raisch & Birkinshaw, 2008). These relationships provide insights into how leaders can promote ambidexterity, given the organisational context. With defined definitions for each of the selected constructs (complexity leadership; exploitation and exploration, and combined contextual ambidexterity; and environmental dynamism). The following section reviews the literature on the relationships between these constructs.

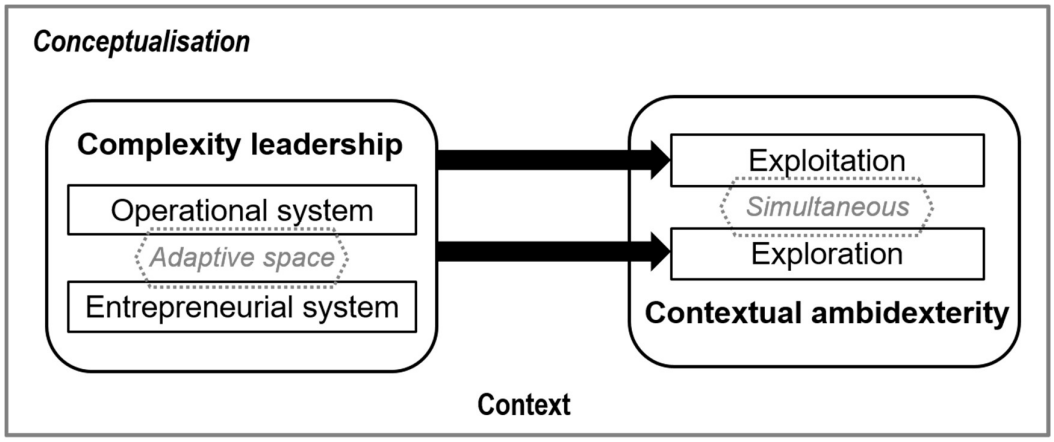
2.5.1. Complexity leadership, exploitation and exploration

Given the importance of both types of innovation (exploitation and exploration), scholars have investigated the influential relationship certain leadership styles have on each type. One such example is Jansen et al. (2009) that empirically established a positive influential relationship between transformational leadership behaviour and exploration, as well as a positive influential relationship between transactional leadership behaviour and exploitation, shown in Figure 32 in Appendix 1.

It would be more effective if one leadership style could drive both exploitation and exploration, as both are required in the increasingly dynamic and complex business environment (Wu & Wu, 2016). Complexity leadership was conceptualised as the overarching framework of the operational (exploitive, administrative, alignment) and entrepreneurial (exploration, adaptive) system, and the adaptive space between these systems (Uhl-Bien & Arena, 2017). It essentially seeks to enable and coordinate both exploration and exploitation (Uhl-Bien et al., 2007), and it places a primary focus on the processes and capabilities that enable this (Clarke, 2013).

From this, complexity leadership will enable, and positively influence, exploitation, as well as exploration. The researcher conceptualised these relationships as shown in Figure 4 below.

Figure 4 – Conceptualisation of the relationship between complexity leadership and exploitation, and exploration.



2.5.2. Complexity leadership and contextual ambidexterity

Leadership and contextual ambidexterity

Leadership, and more specifically senior executives, play a key role in developing organisation ambidexterity (Gibson & Birkinshaw, 2004) as promoters of this organisational trait (Raisch & Birkinshaw, 2008). Tushman and O'Reilly (1996, p.11) describe the real test of leadership as the ability to "compete successfully by both increasing the alignment or fit among strategy, structure, culture, and processes, while simultaneously preparing for the inevitable revolutions required by discontinuous environmental change".

Gibson and Birkinshaw (2004) proposed that contextual ambidexterity can only emerge if leaders develop the correct supportive organisation context. Recently, scholars have started to explore the leadership characteristics that establish this supportive context, and enables organisations to be ambidextrous (Raisch & Birkinshaw, 2008), as existing research suggests that leadership behaviours are important antecedents to ambidexterity (Gibson & Birkinshaw, 2004; Nemanich & Vera, 2009; Tushman & O'Reilly, 1996).

It has been proven that specific leadership styles promote contextual ambidexterity. As an example, Nemanich and Vera (2009) established that transformational leadership is positively related to ambidexterity. Understanding which specific types of leadership styles and behaviours promote ambidexterity could assist organisations to improve leadership selection and leadership development.

Complexity leadership and contextual ambidexterity

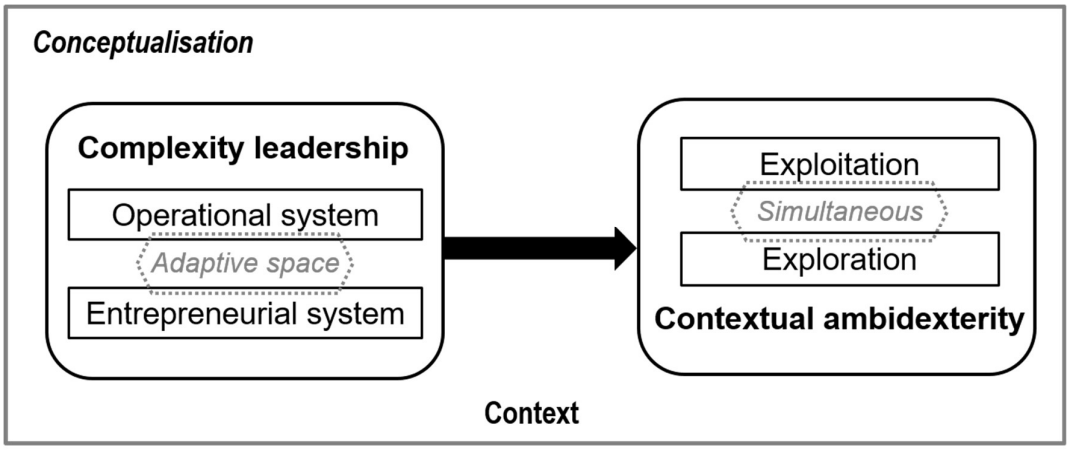
Complexity leadership aims to enable and coordinate exploitation and exploration (Uhl-Bien et al., 2007), allowing for simultaneous exploitation and exploration. It takes a systemic view of the organisation, incorporating both current operations and the adaption to the changing environment. It views the goal of the operational system as efficiency with ongoing results, whereas the goal of the entrepreneurial system is to come up with new ways of working or new products and services (Uhl-Bien & Arena, 2017).

The complexity theory provides the processes utilised by leadership to respond to complexity, which could be used to conceptualise the paradoxical requirements that create tension in more neutral terms (Havermans et al., 2015). It incorporates processes and information sharing to manage tensions and enable collective problem-solving (Clarke, 2013). The adaptive space establishes the connection between the operational and entrepreneurial systems. It acknowledges the need for both operational

(exploitative) and entrepreneurial (exploratory) innovation, and provides leadership with more neutral conceptual processes to coordinate both and manage the conflicting goals (within the adaptive space).

Although the complexity leadership literature describes how leaders should coordinate both exploitation and exploration, the researcher could not find any empirical evidence of the relationship between complexity leadership and contextual ambidexterity. Given the similar aim of simultaneously enabling operation (or exploitation of the current) and the entrepreneurial (or exploration for new ideas), the researcher conceptualised the positive influential relationship between complexity leadership and contextual ambidexterity as shown in Figure 5 below.

Figure 5 – Conceptualisation of the relationship between complexity leadership and contextual ambidexterity



It should be noted that the operational and entrepreneurial systems referred to in complexity leadership, do not represent a split in the organisational structure (dual structures). Given the low-level autonomy for self-organisation required by complexity leadership (Mendes et al., 2016), these systems co-exist and overlap.

2.5.3. Environmental dynamism as moderator

This research hypothesises that environmental dynamism is a moderator variable in the relationship between complexity leadership and exploitation, exploration and contextual ambidexterity. It is crucial to first clarify the term moderator variable.

Moderator variable

Sharma et al. (1981) define a moderator variable as one which systematically alters either the form and/or strength of the relationship between an independent predictor variable and a dependent criterion variable. The numerous definitions of a moderator

variable all agree that moderators affect the nature of the relationship that exists between two other variables (Howell et al., 1986). The moderator variable is a subset of 'specification variables' that affect the strength or magnitude of the relationship or modify the form of the relationship (Sharma et al., 1981). The moderator is an independent qualitative or quantitative variable, at the same level as the predictor variable (Baron & Kenny, 1986).

Baron and Kenny (1986) describe that during a correlational analysis, a moderator is an additional variable that affects the zero-order correlation between the two other variables. Thus, a moderator affects the nature of the relationship between two other variables and is not necessarily correlated with either (Howell et al., 1986). In fact, it is preferred that the moderator variable is uncorrelated with both the independent and the dependent variables as this provides a clearer interpretation of interaction (Baron & Kenny, 1986).

Given the results of the statistical analysis, the moderator can be classified from different perspectives. It can be classified based on its relationship with the criterion variable and whether it interacts with the predictor variable (Sharma et al., 1981). It can also be classified according to the moderating influence found; a positive moderating influence ('enhancers'), or negative moderating influence ('neutralisers') (Howell et al., 1986).

Environmental dynamism as a moderator of complexity leadership and exploitation and exploration

Raisch and Birkinshaw (2008) created a framework that conceptualised available literature of the known antecedents, moderators and outcomes of organisational ambidexterity, shown in Figure 30 in Appendix 1. The literature has identified leadership as an organisational antecedent of organisational ambidexterity and the environmental factors considered include environmental dynamism. From the emerging contingency perspective, the organisation's exploitation and exploration innovation should be analysed considering various contextual conditions (Raisch & Birkinshaw, 2008), such as the rate of change and instability in the organisational context (environmental dynamism).

This research is concerned with how leadership influence exploitation and exploration, and whether environmental dynamism influences these relationships. Jansen et al. (2006, p.20) stated that "environmental dynamism differentially moderates the effectiveness of exploratory and exploitative innovations". However, as hypothesised by Jansen et al. (2009) through a review of available literature, this moderation effect could differ between the two types of innovation.

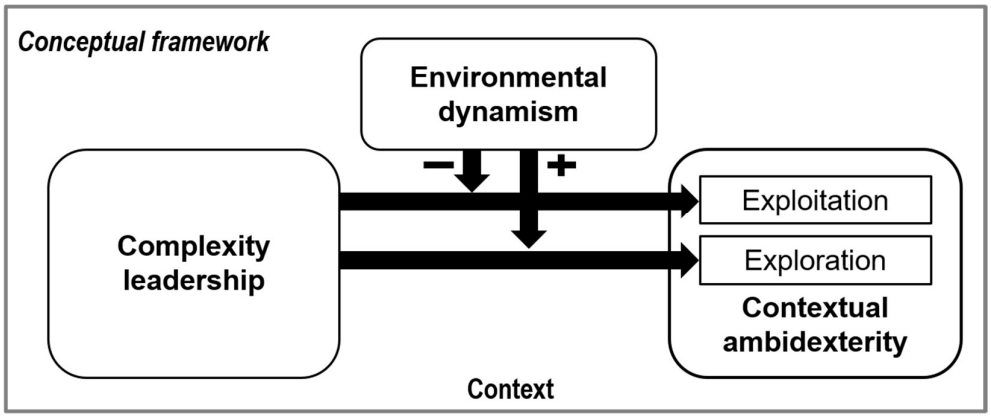
Jansen et al. (2009), also included in the framework developed by Raisch and Birkinshaw (2008), proved that the relationship between a transactional leadership style and exploitative innovation is significantly and negatively influenced by the level of environmental dynamism, as shown in Figure 32 in Appendix 1. When confronted with a dynamic environment, the organisations are less likely to allow a transactional leadership perspective that is internally focused and based on the status quo (Jansen et al., 2009). Thus, a high level of environmental dynamism would shift the organisation's focus to an external one and reduce the efficiency gains of exploitation.

Promoting exploratory innovation is considered more effective in dynamic environments (Jansen et al., 2006) and more importantly, (Tamayo-Torres, Roehrich & Lewis, 2017), contrasted to exploitative innovation. Organisations even drive exploration and information-acquisition in an attempt to reduce the uncertainty posed by the environmental dynamism (Sidhu et al., 2004). The organisation gathers information from the dynamic environment in an experimental manner, designed to discover new alternatives (March, 1991) to meet the needs of emergent or new customers (Raisch & Birkinshaw, 2008). For this reason, Jansen et al. (2009) hypothesised that a high level of environmental dynamism would amplify leadership's influence on exploration. Although this could not be proven empirically, the review of the available literature does lead to this conclusion.

Given the contradictory implications of a dynamic environment, Jansen et al. (2009) warn that organisations should apply caution in implementing appropriate leadership styles that is, exploitation and/or exploration in dynamic contexts. From a complexity leadership approach perspective, Clarke (2013) describes how a complexity leadership approach enables an organisation to become adaptable and able to successfully deal with the complex challenges in its dynamic environment. Although the complexity leadership literature incorporates the importance of the organisational task environment, the researcher could not find any empirical evidence of the relationship between complexity leadership and exploitation or exploration being moderated by environmental dynamism.

From this theoretical base, this research concluded that environmental dynamism neutralises (negatively moderates) the complexity leadership efforts to exploit, and environmental dynamism enhances (positively moderates) the complexity leadership efforts to explore. These moderation effects were conceptualised as shown in Figure 6.

Figure 6 – Conceptualisation of the moderator effect of environmental dynamism on complexity leadership and exploitation, and exploration



Environmental dynamism as a moderator of complexity leadership and contextual ambidexterity

Gibson and Birkinshaw (2004) suggested that future research explore whether the level of dynamism in a business environment is boundary condition to contextual ambidexterity. Jansen et al. (2009) considered exploitation and exploration innovation as separate variables and recommended that future research on the moderating influence of environmental dynamism should focus on the coexistence of exploitive and exploratory innovation as a collective (ambidexterity).

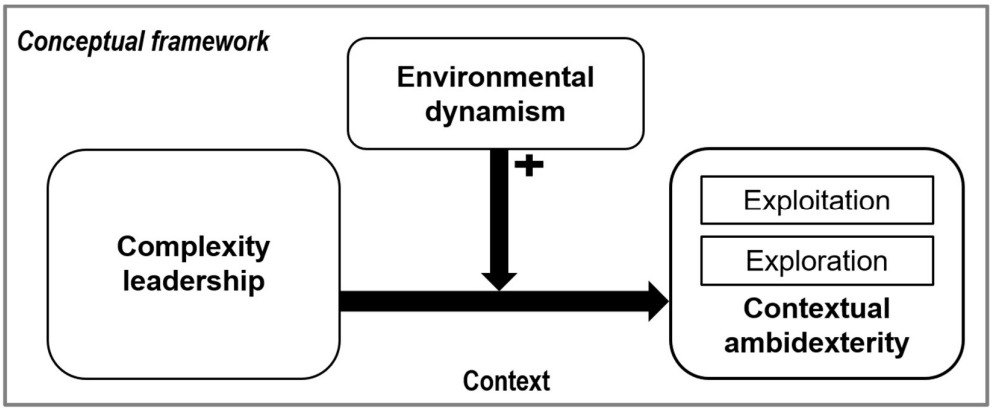
Jansen, van den Bosch and Volberda (2005) established that multi-unit organisations operating within dynamically competitive local environments develop ambidextrous units. Further, Wu and Wu (2016) found that organisations in industries known for dynamism are more likely to adopt a contextual approach to ambidexterity. Thus, environmental dynamism influences the orientation and implementation approach, as well as the effectiveness of contextual ambidexterity.

Since the relationship between complexity leadership and contextual ambidexterity has not yet been empirically established, the effect of the environmental dynamism on this relationship could not be established. The ability of complexity leadership to generate the appropriate innovation (both exploitation and exploration) has been found to be enhanced in complex, fast-changing work environments (Mendes et al., 2016). From the theory base, it is proposed that leadership's effort to establish contextual ambidexterity would be enhanced (positively moderated) by the environmental dynamism.

Thus, the moderating influence of the environmental dynamism on the relationship between complexity leadership and contextual ambidexterity is not yet known, and was

conceptualised as shown in Figure 7 below.

Figure 7 – Conceptualisation of the moderator effect of environmental dynamism on the relationship between complexity leadership and contextual ambidexterity



2.6. Chapter conclusion

From the literature reviewed, it is evident that simultaneous efficient operations that align to what is currently required and active exploration of new opportunities that adapts to future requirements (contextual ambidexterity) is critical for sustained business success. The leadership in an organisation enables this innovation, with an established relationship between specific leadership styles and exploration and exploitation innovation. The relationship between the emerging concept of complexity leadership, and exploration and exploitation innovation, has not been established, neither as separate or combined (contextual ambidexterity) concepts.

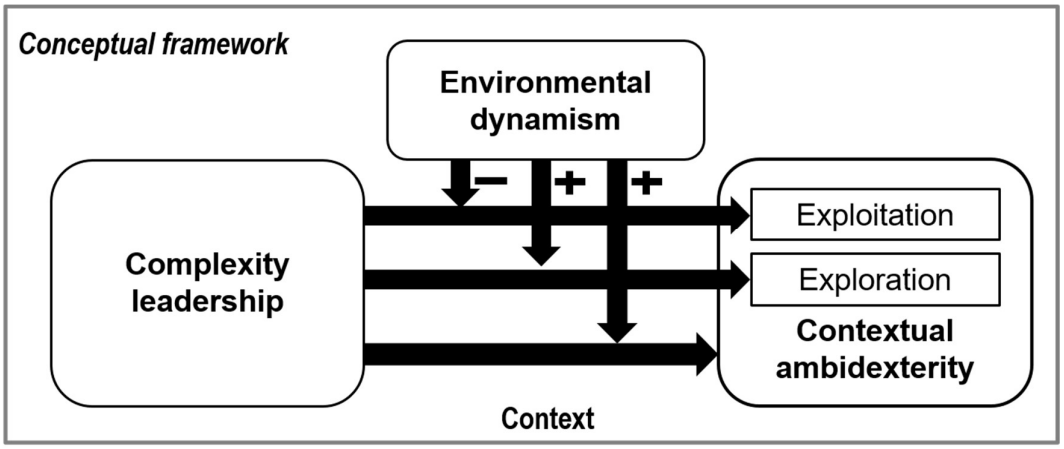
Complexity leadership links with the concept of contextual ambidexterity as both aim to simultaneously drive exploration and exploitation innovation, and both have a systems perspective that incorporates the context in which the innovation occurs.

In addition, environmental dynamism describes the rate of change in the task environment of an organisation. It has been established that environmental dynamism has a negative moderating effect on the relationship between a specific leadership style (transactional leadership) and a type of innovation (exploitation) (Jansen et al., 2009). The relationships between complexity leadership and exploitation exploration and contextual ambidexterity, has however not been investigated with environmental dynamism as a moderator.

Given the literature reviewed, the researcher conceptualises the relationships between complexity leadership and exploitation and exploration; the combined concept of

contextual ambidexterity and the moderating role of environmental dynamism on these relationships as shown in Figure 8 below. Complexity leadership has a positive influencing relationship on exploitation and exploration, as well as contextual ambidexterity, which is (either positively or negatively) moderated by the environmental dynamism.

Figure 8 – Conceptualisation of the relationship between complexity leadership and exploitation, and exploration, as well as contextual ambidexterity, moderated by environmental dynamism



3. Conceptual framework and hypothesis

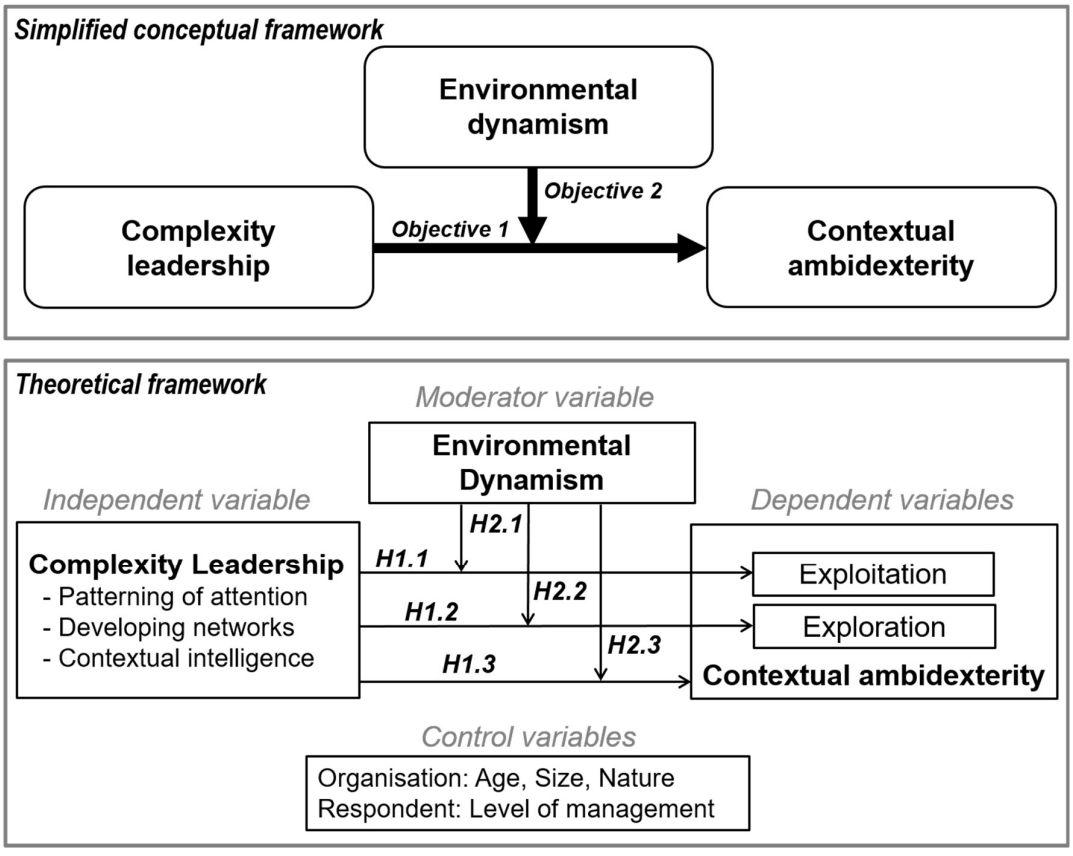
3.1. Conceptual framework

A conceptual framework can be used to derive a theoretical framework, which provides the nature and direction of relationships between operationalised variables. This diagrammatic process helps clarify the research design, defining measurable operational variables and hypothesised relationships, that can be subjected to testing (Burns & Burns, 2008).

Figure 9 below shows the conceptual and theoretical models, depicting the applicable constructs (variables) and the relationships (arrows) this research aims to investigate. The sub-constructs (observed variables) that collectively define the key constructs (latent variables) are also shown.

Complexity leadership is an independent variable, with a positive relationship with the dependent variables, exploitation, exploration, and the combined construct contextual ambidexterity. Environmental dynamism, the independent moderating variable, influences this relationship.

Figure 9 – Complete conceptual and theoretical framework



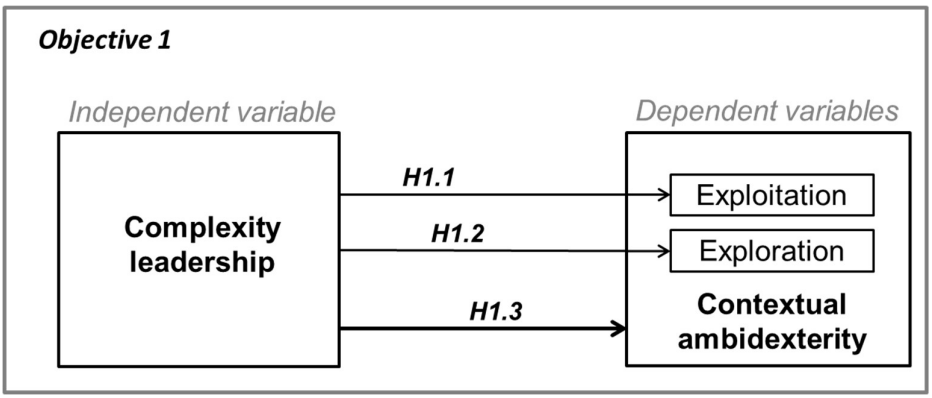
3.2. Hypotheses

Hypothesis statements describe the predicted relationship among attributes or characteristics to be investigated in a quantitative research (Creswell, 2012). The two high-level objectives of this research and the corresponding hypotheses are detailed below.

3.2.1. Objective 1

Confirm that there exists a significant, positive, linear relationship between complexity leadership and exploitation, exploration, and the combined construct, contextual ambidexterity, as conceptualised in Figure 10 below.

Figure 10 – Objective 1



Hypothesis H1.1

H_0: No linear relationship exists between complexity leadership and exploitation.

H_1: A positive linear relationship exists between complexity leadership and exploitation.

Hypothesis H1.2

H_0: No linear relationship exists between complexity leadership and exploration.

H_1: A positive linear relationship exists between complexity leadership and exploration.

Hypothesis H1.3

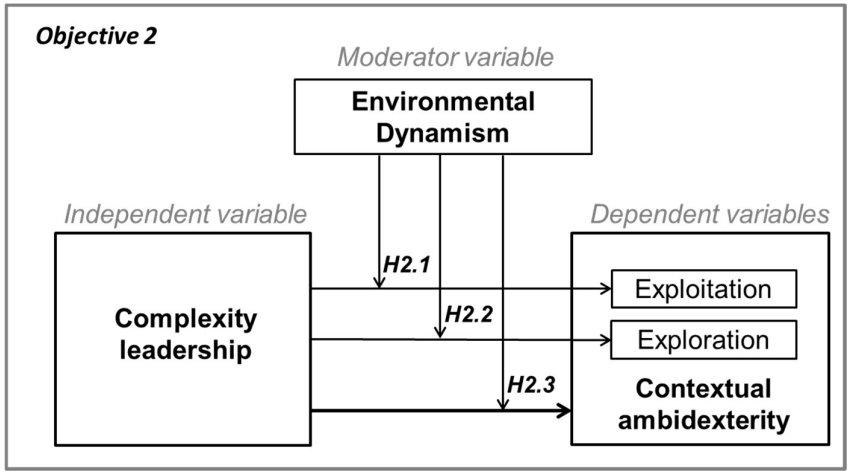
H_0: No linear relationship exists between complexity leadership and contextual ambidexterity.

H_1: A positive linear relationship exists between complexity leadership and contextual ambidexterity.

3.2.2. ***Objective 2***

Given the relationships in Objective 1 is established, confirm that environmental dynamism has a moderating effect on the relationship between complexity leadership and exploitation, exploration, and the combined construct, contextual ambidexterity, as conceptualised in Figure 11 below.

Figure 11 – Objective 2



Hypothesis H2.1

H_0: Environmental dynamism has no moderating effect on the relationship between complexity leadership and exploitation.

H_1: Environmental dynamism has a negative moderating effect on the relationship between complexity leadership and exploitation.

Hypothesis H2.2

H_0: Environmental dynamism has no moderating effect on the relationship between complexity leadership and exploration.

H_1: Environmental dynamism has a positive moderating effect on the relationship between complexity leadership and exploration.

Hypothesis H2.3

H_0: Environmental dynamism has no moderating effect on the relationship between complexity leadership and contextual ambidexterity.

H_1: Environmental dynamism has a positive moderating effect on the relationship between complexity leadership and contextual ambidexterity.

4. Proposed research methodology and data

From the literature reviewed, it was evident that a relationship exists between leadership and contextual ambidexterity. Furthermore, environmental dynamism has been proven to have a moderating effect on the relationship between transformation and transactional leadership and exploration and exploitation innovation. The objectives of this research were to investigate these relationships, with a specific focus on the emerging concept of complexity leadership and contextual ambidexterity.

This chapter describes the research methodology used to support or disprove the relationships hypothesised. The methodology selection was based on the nature of the research hypotheses and the relevant population and unit of analysis.

4.1. Research design

The proposed research design and approach is detailed in Table 3 below. The table details the research methodology components and constructs, as adapted from Saunders and Lewis (2012, p.103). Each component selection is described using relevant literature, followed by the rationale that informed selection thereof for this research.

Table 3 – Research method rationale

Research methodology components	
Overall research approach: **Explanatory**	A correlational design, within which the researcher is interested in the extent to which two variables co-vary, is an explanatory research design (Creswell, 2012)
	This research aimed to investigate the existence of relationship between an independent and dependent variable. With this relationship established, the moderating effect of additional independent variable is considered. In essence, the relationships between the constructs (complexity leadership, contextual ambidexterity, and environmental dynamism) were explained in this research.
Research philosophy: **Pragmatic**	The pragmatic position suggests that the research objectives (hypotheses) are the most important determinant of a research philosophy, guided by what is possible (Saunders & Lewis, 2012). That is, the appropriate procedures should be used, given the research problem (Creswell, 2012).
	The research problem, and objectives, were the most important determinants of the selection of research methodology. It was crucial that the procedures selected for this research were appropriate, and practical.

Research approach: **Deduction**	A theory can be described as the bridge that explains the relationship between an independent and dependent variable (Creswell, 2012). A deductive process starts with theory, or a hypothesis, from which certain logical implications flow, which are tested and, given the results, the initial theory (or hypothesis) is supported or rejected (Burns & Burns, 2008).
	A thorough review of the available literature developed the research objectives and the corresponding hypotheses. The hypothesised relationships between the constructs (complexity leadership, contextual ambidexterity and environmental dynamism) have been deduced from the literature reviewed. No single literature piece stated these relationships outright. However, viewed as a collective with clarity on the different terminology used, the researcher hypothesised that these relationships exist. This research aimed to quantitatively support or disprove these hypothesised relationships.
Research strategy: **Secondary survey data**	The research strategy will be influenced by the research objectives, as well as resources available to the researcher (Saunders & Lewis, 2012), including available data. A survey method is popular in business research as it could meet the research objective of exploratory research well, and assists in collecting data from a large number of respondents (Saunders & Lewis, 2012).
	Secondary data, collected through an ad hoc, self-administered online survey was available for this research. The details of this data set, its research instrument and how it directly links to this research's constructs and objectives is detailed in this chapter. The most noteworthy benefit of this data set is the large size of the sample.
Research choices: **Mono method**	Mixing different methods could allow the researcher to use different approaches at different stages of the research. This includes using qualitative methods to explain a relationship between quantitative variables (Saunders & Lewis, 2012).
	The hypothesised relationships between variables have been deduced from the literature reviewed. A single set of quantitative secondary data was subsequently analysed to support or disprove the hypotheses.
Time horizon of research: **Cross-sectional study**	The cross-sectional data reflects a snapshot in a single time period, collected from multiple groups (Saunders & Lewis, 2012).
	The secondary data available is cross-sectional, as the survey was distributed and responses collected within a relatively small timeframe. It reflects the attitudes of the employees who responded, as at that moment in time.

Enquiry mode:	In quantitative research, relationships among variables are established form literature, identified in more detail and then tested (Creswell, 2012).
Quantitative data analysis	The relationships between the constructs have been identified and statistical analysis was used to support or disprove the hypotheses. The ordinal survey responses, coded numerically, could be statistically analysed as quantitative data after establishing normality.

The cross-sectional, quantitative survey data methodology used for this research is similar to the methodologies of relevant research on this topic, including that of Jansen et al. (2006) and Nemanich and Vera (2009).

4.2. Research population and unit of analysis

The population of a random variable is the collection of all possible data values that exist (Wegner, 2016), and the population parameters are its measurable characteristics (Burns & Burns, 2008; Wegner, 2016). The population parameters of concern were the complexity leadership, contextual ambidexterity and the environmental dynamism at the firm level of any organisation operating in South Africa. All three parameters (or constructs) were applicable in any operational environment, albeit to different extents. Thus, the population could be defined as employee organisations operating in South Africa. The type, size or nature of the organisation served as control variables, to contextualise the results, but did not disqualify any organisation.

The members or elements of a population can be defined as the unit of analysis (Welman, Kruger & Mitchell, 2006), which were the employees themselves in this research. Each respondent's response will be used as a unit of analysis.

4.3. Secondary data

Secondary data was analysed to support or disprove the hypotheses. Secondary data already exists as it has been previously collected and compiled (Wegner, 2016). The possible benefits of using secondary data include, but are not limited to, an increased sample size and a greater number of discrete units of data per sample member, allowing advanced analysis techniques and reduced time and cost of data collection and coding (Vartanian, 2011). Under normal circumstances, gaining access to secondary survey data is challenging (Saunders & Lewis, 2012). However, the research supervisor who oversaw the collection of this data has personally granted the researcher access. Given the direct access to the relevant research supervisor, the particulars on the sampling methodology used and the research instrument itself were all known.

4.3.1. Sampling methodology

Recording every data value of the complete population would be impractical, which calls for sampling a subset of values (Saunders & Lewis, 2012; Wegner, 2016). For practical purposes, researchers could target selected individuals as a sample that represents some characteristic the researcher seeks to study (Burns & Burns, 2008; Creswell, 2012).

Sampling technique

The sampling technique that was used was a two layered non-probability technique, with both convenience sampling and snowball sampling (Saunders & Lewis, 2012). Convenience sampling is a non-random sample of respondents drawn at the researchers' convenience and snowball sampling is then used to increase the sample size as respondents are requested to help identify additional members of the target population (Wegner, 2016). A cohort of MBA students has distributed the online survey to direct contacts within their respective organisations (convenience sampling), and requested that the survey also be forwarded to other colleagues (snowball sampling). Given the diversity of the organisations represented by the MBA cohort, South African employees from a variety of organisational types, sizes, and industries has been sampled.

Sample size

Data drawn from a larger sample size more closely represents the population (Burns & Burns, 2008). For this reason, quantitative analysis emphasises the need for a larger sample size (Kumar, 2014, Chapter 1), and secondary data often provide larger sample sizes (Vartanian, 2011). Each syndicate group in the MBA cohort had been tasked to collect at least 30 responses from a single organisation. A total of 1 323 responses were collected and collated as a single data set.

4.3.2. Measurement instrument

The secondary data has been collected through a uniquely designed and self-administered electronic survey. Electronic surveys are an increasingly popular form of data collection, with advantages including, but not limited to, anonymity of respondents, limited interviewer bias, reduced capturing errors, larger geographical reach (Wegner, 2016), and responses can be coded automatically. The survey has been piloted, improved and granted ethical clearance before distribution. A summarised version of the questionnaire is shown in

Table 34 in Appendix 3. The research instrument (questionnaire) included four components: participation consent, biographical information, control variables as well as

independent, dependent and moderator constructs.

Participation consent

Data collection requires ethical practises including respect for the respondent and transparency of what is being researched (Creswell, 2012). The participation consent section included an introduction to give context to what is being researched, as well as the duration of the survey. It provided contact information of the researchers, should the respondents have any questions or concerns.

Furthermore, survey participants have the right to voluntary participation, informed consent, privacy and confidentiality (Burns & Burns, 2008). The participation consent detailed that responses remain confidential and that the respondent's name would not be recorded. It further explained that completing the survey is voluntary and that the respondent has the right to cease to complete the survey at any stage.

Biographical information

Basic biographic information was requested from each respondent, including: age, gender, level of education, race group, tenure at current organisation and applicable discipline of work. This biographical information provided some description on the respondents, and certain basic descriptive statistics could be analysed.

Control variables

A control variable is an independent variable of secondary interest (Creswell, 2012). Critical control variables have been captured in the research instrument, including: the respondent's level of management, the size and age of the organisation and whether the nature of the organisation is bureaucratic or entrepreneurial. This information provided some description of the organisations of the respondents and certain basic descriptive statistics could be analysed.

Independent, dependent and moderator constructs

The remainder of the questionnaire aimed at quantifying each construct (complexity leadership, contextual ambidexterity and environmental dynamism). It requested the respondent to rate a list of specific questions (as detailed in the following section) on a Likert scale. The Likert scale represents a scale with theoretically equal intervals and it is both popular and well-tested (Creswell, 2012). This scale required respondents to rate grouped questions on an ordinal scale of 'Strongly disagree' to 'Strongly agree', or 'Not at all' to 'Frequently, if not always'. The ordinal responses were subsequently coded numerically, ranging from one (1) to five (5), as interval data.

It should be noted that in this research the organisational attributes complexity leadership, contextual ambidexterity, and environmental dynamism, are expressed as abstract concepts. These attributes are not easy to measure and are not stated in a specific or applied way and are thus referred to as 'constructs', not variables (Creswell, 2012).

These constructs are also not easily or directly observed and are rather a combination of a few observations. Observed variables can be observed and measured using a research instrument, whereas latent variables (constructs or factors) are not directly measurable and are inferred from a set of observed variables, each representing one definition (Schumacker & Lomax, 2010). The construct measurement scales detailed below aimed to give the questionnaire respondents the opportunity to quantify measures (observed variables) that the researcher combined and interpreted as the (latent) constructs.

4.3.3. Construct measurement scales

Operational definitions specify the definition and measurement of variables in a study (Creswell, 2012). Effectively, operational definitions allow measurement of variables on a stated scale (Burns & Burns, 2008), as the definitions are known and consistent. The definitions of each of the constructs have been considered in the literature review section of this document. It is crucial to understand the precise construct definitions used in secondary data (Saunders & Lewis, 2012) to ensure consistency. The questionnaire made use of known existing (or combined) scales for measuring the relevant constructs. The scales used were provided to the researcher.

Exploratory and exploitive innovation

Exploratory and exploitive innovation were each measured using a six-item scale developed by Jansen et al. (2006). This in-depth development of the scales included a literature review, thorough pilot interviews and the incorporation of a range of feedback. The resulting alpha reliabilities, exploratory factor analysis and correlation analysis between the constructs provided strong support for both the reliability and validity of the measures (Jansen et al., 2006; Jansen et al., 2009).

The exploratory innovation scale ($\alpha = 0.86$) captured the extent to which units reach outside current knowledge and pursue innovations for emerging markets or customers (Jansen et al., 2006). The exploitive innovation scale ($\alpha = 0.80$) captured the extent to which units build on current knowledge and meet existing customer needs (Jansen et al., 2006). The scales were originally created to measure the constructs on business unit

level and were adapted by Jansen et al. (2009) for an organisation level measurement.

Contextual ambidexterity

Considered separately, the exploitation and exploration measures in the instrument are tested scales. This research investigated contextual ambidexterity - a combination of these two terms. Gibson and Birkinshaw (2004) originally conceptualised ambidexterity as a multidimensional construct that comprises a non-substitutable combination of alignment (exploitation) and adaptability (exploration).

Lavie et al. (2010) advocated the use of a single variable to capture exploration and exploitation. To accurately represent contextual ambidexterity as a combination of the two concepts, Gibson and Birkinshaw (2004) used a research instrument with two separate scales, measuring both exploitation and exploration. However, during analysis, these measures were combined to represent the contextual ambidexterity variable (Gibson & Birkinshaw, 2004). The multiplicative interactions between exploration and exploitation can be used as a measure for ambidexterity (De Clercq et al., 2014; Nemanich & Vera, 2009). With this, exploration and exploitation could be seen as two separate factors that together, measure contextual ambidexterity.

Complexity leadership

No standard scales are available to measure complexity leadership. The instrument included three main sub-constructs that form part of the theory of complexity leadership. It was believed that combined, these sub-constructs would embody complexity leadership. Each sub-construct has known scales:

- **Patterning of attention**. A leader has the choice to define what constitutes important information (Osborn et al., 2002). Patterning of attention involves this dialogue and discussion, facilitated by leadership, on what is important, rather than what to do or how to do it (Osborn & Marion, 2009). Thus, patterning of attention is a leadership role, associated with contextual leadership (Osborn & Marion, 2009). Osborn and Marion (2009) confirmed the use of the six-item measure for patterning of attention, developed from earlier literature. The scale used for patterning of attention was inferred from this literature.
- **Developing networks**. Organisations are part of unique networks, both internally, and externally (through supplier relationships and partnerships). Osborn et al. (2002, p.817) described how an organisation chooses a network, its network membership, and the internal network linkages. New models of leadership are required, since problem solving is performed by suitably structured social networks (Uhl-Bien et al., 2007). Thus, leaders need to develop effective

networks, both externally and internally. Osborn and Marion (2009) confirmed the use of a six-item scale and from this literature the scale was inferred to measure developing networks.

- **Contextual intelligence**. Contextual intelligence builds on the fact that today's leaders need to be able to foresee and diagnose various contexts, and quickly and seamlessly adapt (Kutz, 2008). This leadership characteristic enables complex adaptive systems. Kutz (2008) developed a list of behaviours, skills and specific descriptions that are associated with contextual intelligence. The 12 meta-competencies identified are believed to be predictors of contextual intelligence (Kutz, 2008). From these 12 statements, the measurement instrument has included seven questions as observed variables of the latent construct, detailed in Table 35 in Appendix 3.

Environmental dynamism

Building on original literature, Volberda and Van Bruggen (1997) developed an instrument to measure environmental turbulence, labelled ENVTURB. The instrument was developed and refined to include 22 reliable items to measure all six dimensions of environmental turbulence, with seven items measuring environmental dynamism (Volberda & Van Bruggen, 1997). From this, whilst considering the seminal literature of Dill (1958), Jansen et al. (2006) simplified the instrument to a five-item measure for environmental dynamism. The resulting scale ($\alpha = 0.87$) expressed the rate of change, as well as the instability of the external environment (Jansen et al., 2006). This scale from Jansen et al. (2006) has been used to measure environmental dynamism.

4.4. Data analysis steps

The available secondary data was analysed to investigate the research hypotheses. According to Kumar (2014), quantitative data analysis requires three data processing steps; editing, coding and analysis.

4.4.1. Editing

Data must be scrutinised to address inconsistencies and incompleteness (Kumar, 2014). Two aspects were addressed; missing values and outlier values.

Missing values

All data sets have missing data values, that affect statistical analysis, and the researcher must decide on whether to delete or replace missing data points (Shumacker, & Lomax, 2010). The sample size would influence this decision. In this sample data set, a few observations included missing values. Given the large sample size, the responses with

missing values were removed.

Outlier values

Quantitative data must be checked for out-of-range values, or outliers, to increase the quality, before the statistical analysis is done (Wegner, 2016). Mahalanobis distance can be used, as it provides an indication of whether or not an observation is an outlier in comparison to the independent variable values (Hill & Lewicki, 2006). Hill and Lewicki (2006) explained that the Mahalanobis distance is calculated as the distance of a value from the centroid (midpoint) in a multidimensional space.

Thus, if this distance of an observation to the mean (centroid) is too large, the observation is considered an outlier and could be removed from the data set. For this sample data set, the Mahalanobis distance analysis indicated a few observations far from the centroid (outliers), which were subsequently removed.

Overall, during the data editing process, a total of 119 responses were removed and a sample of 1 204 responses remained. This sample is sufficient, as Creswell (2012) describes that the sample should be as large as possible, with a minimum of 350 required for survey data.

4.4.2. Coding

Survey responses are transformed for analysis using a code book, coding variables (Kumar, 2014). The secondary data has already been coded as the electronic survey questions were pre-coded by the original researcher, using the online survey software. The responses were captured as coded data, ready for quantitative analysis.

It should be noted that all questions were posted as positive, except Q12_18, which measured ED4. Thus, the answers to the question “in a year, nothing has changed in our market” were inverted. This was done by subtracting the response from the maximum of the scale, plus one (Field, 2014), i.e. six minus the response.

4.4.3. Analysis

Introduction to analysis

A frame of analysis must be developed and appropriate software tools utilised (Kumar, 2014). A large part of this research focused on detecting and describing the relationships among observed or latent variables. These statistical techniques are all based on correlation analysis, and could be used for (Pallant, 2011):

- Factor analysis – Identification of the underlying structure of a group of related variables;
- Correlation – Exploring the association between two variables;
- Regression – Predicting scores on one variable, given scores on another variable;
- Multiple regression – Predicting scores on a dependent variable, given scores of more than one independent variable.

Construct naming convention

For consistency, the constructs notations used throughout the data analysis are shown in Table 4.

Table 4 – Acronyms for constructs and items

Acronym	Construct (Latent variable)
CL	Complexity Leadership
Exploi	Exploitation
Explo	Exploration
CA	Contextual ambidexterity
ED	Environmental Dynamism
Acronym	**Item (Observed variable)**
PA	Patterning of Attention
DN	Developing Networks
CI	Contextual Intelligence
Exploi	Exploitation
Explo	Exploration
ED	Environmental Dynamism

Statistical analysis used

The remainder of this chapter describes the different statistical analyses used to firstly, determine the reliability and validity of the data, and then to support of disprove the hypotheses. The researcher followed the data preparation process detailed in Table 5, of which a description and results are provided in this chapter.

Table 5 – Analysis preparation process followed, with a description and the results provided in this chapter

Analysis step	Purpose	Analysis or methodology used
Data preparation		
Data editing and preparation *(as described above)*	Removed missing values and observations furthest form the centroid.	Observation of missing values. Mahalanobis distance.
Instrument reliability and validity		
Reliability of instrument	Confirmed reliability of the scales used.	Cronbach's coefficient alpha.
Convergent validity: Exploratory factor analysis	Determined the suitability of the data for factor analysis.	Kaiser-Meyer-Olkin, and Bartlett's Test of Sphericity.
	Determined number of factors to consider.	Kaiser's criterion (eigen values), and total variance explained.
	Confirmed CL, Explo, Exploi, and ED factors through rotation and interpretation.	Orthogonal rotation (Varimax with Kaiser Normalisation). Principal Components Analysis.
Discriminant validity: Correlation	Confirmed discriminant validity of the latent variables.	Pearson correlation matrix.
Test normality assumptions		
Test for normality	Established normality per variable.	Skewness and Kurtosis formulas.

After the necessary confirmations of data appropriateness in the preparation process above, the researcher could continue with the analysis. To relate variables and investigate predictors Creswell (2012) recommend the analysis steps of factor analysis, descriptive statistics and then regression analysis. The data analysis process followed is detailed in Table 6 below. Details of what process was followed and why, are provided in this chapter, and the results thereof are provided in the following chapter.

Table 6 – Data analysis process followed, with a description in this chapter, and the results in the following chapter

Analysis step	Purpose	Analysis or methodology used
Introductory analysis: Descriptive statistics		
Descriptive statistics	Explained sampled respondents (biographical), and organisations represented (control variables).	Frequency and percentages statistics.
	Interpreted responses each construct: CL (independent), Explo and Exploi (dependent) and ED (moderator).	Central tendency and variability.
Analysis: Regression analyses to support or disprove the hypotheses		
***Objective 1*:** **Regression analysis**	*H1.1*: Determined relationship between CL and Exploi.	Graphically: Scatterplot Statistically: Simple linear regression analysis, with method of least squares.
	H1.2: Determined relationship between CL and Explo.	
	H1.3: Determined relationship between CL and CA.	
***Objective 2*:** **Moderator multiple regression analysis**	Investigated the level of multicollinearity.	Variance inflation factor, and tolerance.
	H2.1: Determined if ED has a negative moderator effect on the established relationship between CL and Exploi.	Ordinary Least Squares Regression Models. Hayes (2013) SPSS PROCESS macro.
	H2.2: Determined if ED has a positive moderator	

	effect on the established relationship between CL and Explo.	
	H2.3: Determined if ED has a positive moderator effect on the established relationship between CL and CA.	

Significance confidence interval

Throughout the statistical analysis, a significance confidence interval of 95% was assumed. Where otherwise indicated, a 99% confidence interval was assumed.

4.5. Instrument reliability and validity

Before statistical analysis was performed, both the reliability and validity of the secondary data instrument was first determined.

4.5.1. Reliability of instrument

There is consensus that a scale must be reliable to be credible and possess practical utility (Peterson, 1994). Reliability of the instrument can be defined as the degree to which measures are free from error and consequently, yield consistent results (Peter, 1979). Reliability of an instrument means that scores from the instrument are both stable and consistent. Stability shows that the scores are nearly the same when administered at different times and consistency shows that an individual answered closely related questions consistently (Creswell, 2012).

Reliability: Cronbach's Coefficient Alpha

Stability over time is crucial in longitudinal data, whereas internal consistency is of importance in a cross-sectional study (Peterson, 1994). Thus, the cross-sectional data of this study should be analysed for internal consistency. The internal consistency of responses can be analysed using a coefficient alpha, known as Cronbach's alpha (Creswell, 2012). The Cronbach's coefficient alpha, originally developed by Cronbach (1951), is one of the most widely used measures of scale reliability (Peterson, 1994; Bonett & Wright, 2015), and is the most commonly accepted formula for multi-items scales (Peter, 1979; Peterson, 1994). This is critical, as all three constructs (complexity leadership, contextual ambidexterity, and environmental dynamism) were measured using multi-item scales. Multi-item scales allow measurement errors to cancel out against each other, which increases the reliability of the scale (Peter, 1979).

Cronbach's alpha reliability, denoted by α (Cronbach, 1951), describes the reliability of a sum (or average) of all items measured (Bonett & Wright, 2015). The minimum acceptable alpha coefficient value for reliability is a function of the research purpose and

the selected construct being measured (Peterson, 1994), but typically a coefficient of 0.93 is considered high and a coefficient of 0.6 is the minimum satisfactory level for reliability (Creswell, 2012).

Reliability: Results

The Cronbach's alphas were calculated with the Reliability Analysis function in SPSS, and are shown in Table 7 below.

Table 7 – Reliability: Cronbach's alpha

Scale	Cronbach's α
Complexity Leadership	0.962
Exploitation	0.894
Exploration	0.902
Environmental Dynamism	0.716

The three sub-construct scales used to measure complexity leadership together resulted in a high level of reliability, above 0.93 (Creswell, 2012). The exploitation and exploration scales have a satisfactory reliability, with Cronbach's alpha above the minimum satisfactory level of 0.6 (Creswell, 2012). All the questions that measured these three constructs contributed a satisfactory amount and were included.

Environmental dynamism, however, only achieved a 0.694 Cronbach's alpha. Further analysis was performed, in an effort to improve this coefficient. It revealed that the coefficient increased to 0.716 by removing two specific questions, ED1 and ED4. The three remaining scale questions (ED2, ED3 and ED5) measured a satisfactory amount of 71.6% of the construct. Questions ED1 and ED4 were excluded during the analysis, and ED2, ED3 and ED5, were used as the observed variables for environmental dynamism.

Reliability of measures are a required condition for validity (Peter, 1979). Given that the reliability of the scales was determined to be satisfactory, it could feasibly be determined whether the scales measured the intended constructs.

4.5.2. Validity of instrument

Valid measurement is an essential condition of science (Peter, 1979). Peter (1979) describes that the validity of an instrument refers to the degree to which instruments truly measure the intended constructs. One type of validity is construct validity, which Pallant (2011) described to involve the testing of a scale in terms of theoretically derived

hypotheses, with the nature of the underlying construct known. It is explored by investigating its relationship with other constructs, both related (testing convergent validity) and unrelated (testing discriminant validity) (Pallant, 2011).

The convergent validity was analysed to establish the relationships between observed variables that should together, given the theoretical basis of the scales used, measure the latent variables. The degree to which the data matches the expected structure can be determined through factor analysis (Hair, Black, Babin & Anderson, 2010).

Discriminant validity was analysed to establish the relationships between the latent variables, given the theoretical basis of which variables should not be related. To ensure variables that should not have associations do not, a correlation analysis can be used (Pallant, 2011).

Factor analysis

The primary use of Factor analysis is summarisation and data reduction, and achieves this by defining the underlying structure among the variables and grouping highly interrelated variables (Hair et al., 2010). Schumacker and Lomax (2010, p.164) describes that Factor analysis determines which sets of observed variables share common variance–covariance characteristics, and together define a construct (latent variables). The Factor analysis technique either confirms that the subset of observed variables defines the construct, or explores which do (Schumacker & Lomax, 2010).

Exploratory Factor Analysis

Factor analysis is done from either an exploratory or a confirmatory perspective (Hair et al., 2010). Exploratory Factor Analysis (EFA) tests which of the observed variables load onto which latent variable, without any restriction. It is predominantly used to understand the structure of a set of variables, to develop a questionnaire to measure latent constructs, or to reduce a data set to a more manageable size (Field, 2014).

As stated above, the questionnaire questions were based on known scales, including the three sub-constructs used to measure the construct complexity leadership. Given this, the researcher knows which questions (observed variables) are expected to load onto each latent construct. Traditionally, confirmatory factor analysis is performed when the researcher has a preconceived model of the structure of the data, based on theory (Hair et al., 2010). Nonetheless, the three sub-constructs were identified from a range of literature sources, and it has not yet been established whether these sub-constructs measure (load onto) complexity leadership. Given this uncertainty the researcher used

EFA for confirmation.

EFA: Steps required

Pallant (2011) details the three steps required to perform a factor analysis; assessment of the suitability of the data for factor analysis; factor extraction to determine smallest number of factors and factor rotation and interpretation. The methods used in each of these steps, as well as the prescribed thresholds, are detailed in Table 8 below.

Table 8 – EFA steps and requirements

EFA steps	
Suitability of data: **Kaiser–Meyer–Olkin (KMO)** and **Barlett's Test of Sphericity**	The Kaiser-Meyer-Olkin (KMO) test is recommended for sample sizes greater than 300 (Field, 2014). KMO, and Barlett's Test of Sphericity measures were calculated to ensure that the sample is adequate for factor analysis.
	To proceed to the factor extraction, the KMO measure should be above 0.6, and the Bartlett's Test of Sphericity statistical significant (Pallant, 2011).
Number of factors: **Kaiser's criterion**	Ensure practical significance of derived factors (Hair et al., 2010) by considering factor eigenvalues (Pallant, 2011).
	Only include components with an eigenvalue of 1 or more (Field, 2014; Pallant, 2011).
Number of factors: **Total variance explained**	With the components of eigenvalues of 1 or more, the total variance explained should be considered (Pallant, 2011).
	Components that contribute to 60% of the total variance explained is considered satisfactory (Hair et al., 2010).
Factor rotation and interpretation: **Varimax rotation**	The extraction of principal components aims to maximise the variance explained(varimax) (Hill & Lewicki, 2006). Varimax rotation, the most common orthogonal approach, attempts to minimise the number of variables with high loadings on each factor (Pallant, 2011).
	Items are associated with the components which with they have the highest loading (Pallant, 2011).

EFA Results: Kaiser-Meyer-Olkin (KMO), and Barlett's Test of Sphericity

The exploratory factor analysis was performed to test the structure of the six constructs involved in the study. The Kaiser-Meyer-Olkin (KMO) and Barlett's Test of Sphericity analysis results are shown in Table 9.

Table 9 – Kaiser-Meyer-Olkin and Barlett's Test results

Kaiser-Meyer-Olkin and Barlett's Test results		
Kaiser-Meyer-Olkin Measure of Sampling Adequacy		*0.961*
Bartlett's Test of Sphericity	Approx. Chi-Square	33285.862
	df	703
	Sig.	.000

The suitability of the data is supported as the KMO is above 0.6; and the Barlett's Test of Sphericity is significant.

EFA Results: Kaiser's criterion, and total variance explained

Given the suitability of the data, the factor extraction could proceed. The contribution of each factor to the total variance was determined, shown in Table 10 below.

Table 10 – Initial Eigenvalues

	Initial Eigenvalues		
Component	**Total**	**% of Variance**	**Total variance explained (%)**
1	14.263	37.534	37.534
2	5.289	13.918	51.451
3	1.540	4.054	55.505
4	1.448	3.810	59.315
5	*1.063*	*2.797*	*62.111*

Principal component analysis revealed the presence of five (5) components with eigenvalues exceeding 1. Component number 1 obtained the highest eigenvalue (14.263), which corresponds to 37.534% of the total variance, while component number 5 obtained a low eigenvalue of 1.063, which represents 2.797% of the total variance. Whether the fifth component should be included requires further analysis, as Kaiser's criterion has been criticised for retention of too many factors (Pallant, 2011).

The total variance explained provides insight. The first four factors account for (explain) 59.13% of the total variance explained, very close to the 60% satisfactory threshold (Hair et al., 2010). As the purpose of factor analysis is to reduce the number of factors extracted, only four factors were considered further.

EFA Results: Varimax rotation

To aid in the interpretation of these four factors, a Varimax rotation analysis was performed, shown in Table 36, in Appendix 4. For each item, the highest loading value is highlighted (Principle Component Analysis), indicating to which construct it loads.

The Varimax analysis determined the items associated with each of the four components. The results are as follows:

- The first component (complexity leadership) includes 19 items (from PA1 to CI7). These 19 items could not be used as sub-groups as they are all strongly correlated with each other, and separation could have caused discriminant validity issues.
- Exploration and exploitation was associated with 7 items each.
- Environmental dynamism was associated with 5 items.

This finding of the EFA is consistent with the structure of the questionnaire scales. Importantly, it confirmed that the three sub-constructs used to measure complexity leadership (PA, DN, and CI) do load onto complexity leadership, and no other construct. Consequently, to summarise each of the constructs data, the responses to the scale questions were averaged per respondent.

The EFA confirmed convergent validity; the observed variables do converge to measure the intended latent variables. The Varimax rotation did indicate certain small loadings of exploitation items onto exploration, and visa-versa. To ensure that this does not show discriminant validity concerns, the relationships between the latent constructs were investigated through a basic correlation analysis.

Correlations between latent constructs

Correlation analysis is a statistical test to determine the tendency for two (or more) variables to vary consistently (Creswell, 2012). By definition, the groups of observed variables that together, measure a latent variable, are highly correlated (Hair et al., 2010). The higher-level latent constructs do not, however, all have theoretically justified associations. The associations were investigated with a Pearson correlation matrix, shown in Table 11 below.

Table 11 – Correlation matrix

Correlation matrix				
	Complexity leadership	**Exploitation**	**Environmental Dynamism**	**Exploration**
Complexity leadership	1			
Exploitation	0.481	1		
Environmental Dynamism	0.312	0.632	1	
Exploration	0.444	*0.816*	0.673	*1*

The discriminant validity concern was most pronounced for the sub-constructs exploitation and exploration, with the highest correlation of 0.816, above the ±0.5 threshold that indicates a large effect (Field, 2014). This relationship is interesting, but not problematic for the following reasons:

- These latent constructs belong to the same high-level construct: contextual ambidexterity. This is theoretically justified as Gibson and Birkinshaw (2004, p.216) originally "conceptualised ambidexterity as a multidimensional construct comprised of the non-substitutable combination of alignment and adaptability" (or exploitation and exploration). For this reason, this discriminant validity concern supports the literature reviewed and the conceptualised model.
- These two dependent variables were separated for the hypothesis tested, to measure exploitation and exploration, and then combined to create the construct contextual ambidexterity. The discriminant validity did not pose a concern for the main statistical analyses.

Additionally, the correlations between environmental dynamism and both exploitation, and exploration, were also high. All these correlation coefficients were above the ±0.5 threshold that indicates a large effect (Field, 2014). This unexpected correlation poses further questions regarding the relationship between environmental dynamism and exploitation, and exploration. The researcher consequently performed further enquiry into this relationship, detailed in the next chapter.

In summary, discriminate validity concerns were highlighted, but none were considered to be problematic. With convergent validity established through EFA and discriminant validity confirmed through a correlation analysis, the overall construct validity was established (Pallant, 2011).

4.5.3. Test for normality: Skewness and Kurtosis

All assumptions need to be tested. It should be determined if the data is normally distributed, as this is a prerequisite for the Likert scale data to be seen as interval, and not ordinal data (Creswell, 2012). Normality can be tested with: Skewness, to confirm the symmetry of the distribution; and Kurtosis, to measure the 'peakedness' of the distribution (Hair et al., 2010; Hill & Lewicki, 2006).

Data can be considered to be normally distributed if the standardised Skewness and Kurtosis values are between -2.58 and +2.58, which corresponds to a 0.01 significance level (Hair et al., 2010). Table 12 summarises the Kurtosis and Skewness measures per variable.

Table 12 – Standardised Kurtosis and Skewness measures per variable

Variable	Kurtosis	Skewness
CL	- 0,14	- 0,60
Exploi	1,04	- 0,91
Explo	0,19	- 0,80
CA	0,72	- 0,84
ED	0,54	- 0,72

All Skewness and Kurtosis values were between these critical values and as a result, all variables can be considered to be normally distributed. Complexity leadership's distribution has a negative Kurtosis, which indicates a platykurtic or flatter distribution (Hair et al., 2010). All the Skewness measures are negative, which indicates a rightward shift (Hair et al., 2010), which indicated that responses tended to be 'agree', or 'strongly agree'.

With both the reliability and validity of the measurement instrument confirmed, and the assumption of normality, the researcher could continue to descriptive statistics and analyses to support or disprove the hypotheses.

4.5.4. Descriptive statistics

The biographical information and control variables captured by the questionnaire allow for determination of descriptive statistics. These descriptive statistics provided valuable insight as they summarise the overall trends and tendencies in the data (Creswell, 2012) that convey more precise information about the behaviour of the random variables (Wegner, 2016). The main statistics used are frequency and percentages.

Descriptive statistics can also be calculated for the measured variables (constructs). These statistics provide an understanding of how varied the responses are, and provides insight into how the variable scores compare (Creswell, 2012). This includes the central tendency (mean, mode, median), variability (standard deviation, variance, range), and relative standing (percentile ranks) (Creswell, 2012), of each of the measured constructs. The descriptive statistics calculated is detailed in the next chapter.

4.6. ***Objective 1*: Regression analysis**

Objective 1 investigates the linear relationships between complexity leadership and exploitation, exploration, and the combined construct, contextual ambidexterity. Regression analysis could be used as it is a statistical analysis that aims to quantify a relationship between variables, with a measure of the strength of that relationship

(Wegner, 2016). Regression is utilised when the researcher is interested in prediction *per se*, to find the linear combination of a set of predictors to provide a point estimate of the dependent variable (Mason & Perreault, 1991). A regression analysis provides an indication of how the behaviour of predictor variables influence the behaviour of a dependent variable.

Regression is a parametric inferential statistic, utilised when both the dependent and independent variables are continuous, with a normal distribution (Creswell, 2012). Thus, regression could be performed with the secondary data as normality was established.

4.6.1. Simple linear regression

In simple linear regression, there is one dependent variable, denoted with Y, and one independent variable, denoted with X (Wegner, 2016). The relationship between these two variables are expressed as a linear equation. The coefficient of X indicates the relative size of its effect on Y. Expressed as:

$$Y = b_0 + b_1 X$$

The coefficient b_1 indicates the number of standard deviations y would shift, given one standard deviation shift in X. Thus, the regression coefficient provides an indication of the extent to which the independent variable X is associated with the dependent variable Y (Hair et al., 2010). Further, a positive coefficient b_1 indicates a positive linear relationship. It should be noted that the intercept b_0 only has interpretation value if x can conceptually be equal to zero (Hair et al., 2010).

Method of least squares

Regression analysis uses the method of least squares. The method of least squares guides the regression analysis to find the best-fitting straight-line equation, by minimising the sum of the squared deviations of all the data points from the line (Creswell, 2012; Wegner, 2016).

The model's predictive accuracy is calibrated by the magnitude by R^2, as well as the statistical significance of the overall model (Mason & Perreault, 1991). This provides an indication of the significance of the linear relationship proposed. In regression, the variation in the dependent variable is explained by two factors (Creswell, 2012):

- The variance of the independent variables, which provides the relative importance of each predictor – the size of the significant coefficient (b_x);
- The combined effect of all the independent variables, which provides the proportion of the dependent variance explained by all independent variables – the size of R^2 explains the total variance that the model accounts for.

Scatter plot

The relationship between a pair of variables can be examined graphically by producing a scatterplot of the data (Wegner, 2016), which is typically done as the first step in regression analysis (Field, 2014). The data is plotted on a two-dimensional graph, with the dependent variable on the y-axis, and the independent variable on the x-axis. The pattern of the data plotted indicates the nature and strength of the relationship between the variables (Wegner, 2016).

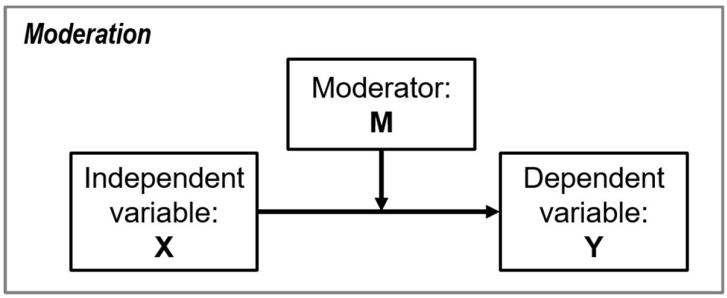
4.7. *Objective 2:* Moderator multiple regression analysis

Objective 2 investigates the moderator effect of environmental dynamism on the linear relationships between complexity leadership and exploitation, exploration, and the combined construct, contextual ambidexterity. Moderator analysis was used to investigate this objective, that required a multiple linear regression analysis. This analysis methodology is similar to those used by scholars investigating the moderator effect of environmental dynamism on the relationship between leadership and exploitation and exploration, including Jansen et al. (2009).

4.7.1. Moderator analysis

Moderation analysis uncovers the boundary conditions for an association relationship between two variables (Hayes, 2013). The boundary conditions of a causal association are concerned with "when" a variable (X) affects another variable (Y), and when it does not (Hayes, 2013). Hayes (2013) explains that the association between variable X and Y is moderated when this association's size or sign depends on a third variable M. Thus, an interacting moderator variable M influences the magnitude, or direction, of the causal effect of independent variable X on dependent variable Y. Graphically, the interaction between the three variables is conceptualised in Figure 12 below.

Figure 12 – Moderator model, adapted from Hayes (2013)

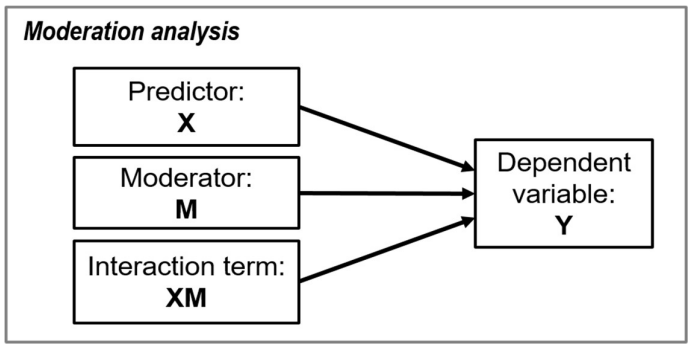


Statistically, moderation analysis tests for interaction between M and X, in a model of Y (Hayes, 2013). Given a simplistic linear relationship between X and Y, Ordinary Least Squares Regression Models can be used to statistically determine the significance of the moderator (Dawson, 2014). It should be noted that the moderation effect hypothesised is linear, and both the independent and moderator variables are continuous variables. Given these prescriptions (Baron & Kenny, 1986), the standard linear regression equation is expanded to include the moderator variable and an interaction term XM, a product term (Aiken & West, 1991), created by multiplying X and M. With the relevant coefficients, the equation can be written as follows (Dawson, 2014; Hayes, 2013):

$$Y = b_0 + b_1X + b_2M + b_3XM + \varepsilon$$

The coefficient of the interaction term, b_3, is used to determine the statistical significance of the moderator and whether we observe moderation (Dawson, 2014). Thus, statistically moderation is graphically conceptualised as shown in Figure 13 below.

Figure 13 – Statistical moderation model, adapted from Field (2014) and Baron and Kenny (1986)



In effect, the moderator and interaction term are included as independent predictors in the multiple linear regression model, on the same level with regards to their role (Baron & Kenny, 1986). If the interaction is found to be significant the relationship is probed further by plotting the interaction, and through a post hoc analysis (Aiken & West, 1991).

The moderator effect of environmental dynamism could be determined for exploitation, and exploration, as well as a combination of these constructs, contextual ambidexterity. In a similar study, Gibson and Birkinshaw (2004) combined the measures for exploitation and exploration, to represent contextual ambidexterity.

Thus, to test the research hypotheses, the regression terms could be considered as follows:

Y: Exploitation, or Exploration; or Contextual ambidexterity;

X: Complexity leadership;

M: Environmental dynamism;

XM: Interaction term (Complexity leadership × Environmental dynamism).

Multiple linear regression analysis

Multiple linear regression analysis, based on simple linear regression, assumes more than one independent variable relates to the dependent variable outcome (Creswell, 2012; Wegner, 2016). Mason and Perreault (1991) explained that it is used where the researcher is interested in finding the linear combination of a group of predictor variables, that provides the best point estimate of the dependent variable, across a range of observations.

It is one of the most widely used statistical procedure, for scholarly and applied marketing research, as it can be applied to varied types of data and problems, its ease of interpretation, robustness, and availability (Mason & Perreault, 1991). Overall, multiple regression provides a few insights (Hair et al., 2010):

- The relevant importance of prediction with each independent variable;
- The nature of the relationship between the independent predictor variables, and the dependent variable;
- The relationships among independent variables in the prediction of the dependent variable (multicollinearity described below).

Multicollinearity

A concern in regression analysis with more than one predictor is multicollinearity (Field, 2014; Mason & Perreault, 1991). High levels of collinearity could be problematic for regression analysis: untrustworthy coefficients, limited size of R, and reduced visibility of the relative importance of each predictor (Field, 2014). This is due to the fact that the collinearity between predictors indicate that the prediction of the dependent variable is not independent, which reduces its significance (Boslaugh & McNutt, 2008). Before the multiple regression analysis could be performed a multicollinearity analysis was performed.

Multicollinearity can be investigated with variance inflation factor (VIF) (Boslaugh & McNutt, 2008), an indicator of the strength of a linear relationship between the predictors (Field, 2014). A related statistic is the tolerance, calculated as the reciprocal of VIF (Field, 2014).

A VIF of between 1 and 2 essentially indicates no collinearity (Boslaugh & McNutt, 2008). When interpreting the VIF and tolerance calculated, the following guidelines indicate that

there is no cause for concern (Field, 2014):

- The average VIF calculated should not be substantially greater than 1;
- The largest VIF calculated should not be greater than 10;
- The tolerance should be above 0.2.

Interpreting R^2

The minimum R^2 that can be found statistically significant depends on the sample size, the selected significance level, as well as the number of independent variables in the analysis (Hair et al., 2010). For a sample size above 1 000, at significance level of α = 0.05, with between 2 and 5 independent variables, the minimum acceptable R^2 is 0.01.

Centring of variables

When an interaction term is included in a model the coefficients of the predictor terms are distorted and cannot be interpreted (Field, 2014). One common method to resolve this issue is to centre the predictor variables (Aiken & West, 1991), which can be done through grand mean centring (Field, 2014). The independent variable responses are centred by subtracting them from the mean (or average) for that variable, thereafter the interaction term is determined (which is then also centred).

PROCESS

Software resources are available that assist with the analysis (Dawson, 2014). Hayes (2013) developed the moderator analysis software called PROCESS. PROCESS is an add-on application to SPSS, that performs all the necessary regression analysis, and provides inference (Hayes, 2013). PROCESS is easy to use and requires a basic variable specification, and definition of the role of each of the variables in the model. PROCESS incorporates the centring step as part of its analysis (Field, 2014). The SPSS PROCESS macro was used for the moderator analysis.

4.8. Limitations of methodology

By nature, all research has limitations. In a quantitative research such as this, the limitations are often related to data collection and analysis, and could include: inadequate or errors in measurement of variables, loss of participation and small sample size (Creswell, 2012). This section details the limitations in the research design, as a result of the use of secondary data, which includes its data collection, the variables measured; the cross-sectional design; and the limitations of the statistical analyses performed.

Secondary data

A noteworthy limitation of using secondary data is a lack of control over how the survey items are framed and described (Vartanian, 2011), and that the data might not be problem specific (Wegner, 2016). Even though the instrument was designed with this research problem in mind, no alterations can be made. An ongoing review of the current literature might reveal new aspects of the problem, not incorporated during data collection.

Wegner (2016, p.14) also states that secondary data "might be out of date". At the time of statistical analysis, this data will be more than a year old.

Data collection

The electronic format of the survey inherently limited the respondents to individuals with computer and internet access (Wegner, 2016). The sample itself could be biased as the MBA cohort only contacted certain organisations, and certain individuals through convenience and snowball sampling methods, both non-probability sampling methods. Non-probability sampling methods are limited in that it could be unrepresentative of the true population, increasing the difference between the sample statistic and the true population parameter (Wegner, 2016), resulting in sampling error.

Further, the data collected is geographically limited to a South African context, where all respondents are employed. The effect of this specific context (macro environment), will not be evident and the findings are not international.

The secondary data was collected from a range of organisations, and the organisation's details was not included in the control variables. As a result, individual organisational level analysis will not be possible.

Variables measured

This research used observed variables to measure latent variables (constructs). In statistics, it is assumed that all of the observed variables are perfectly valid and reliable, which is unlikely in practice (Schumacker & Lomax, 2010). The validity and reliability of the observed variables used could be a limitation as the respondent's understanding of the observed variable is not tested.

This research identified specific constructs to measure, ignoring all other influencing factors. This is a simplified view of ambidexterity as Raisch and Birkinshaw (2008) identified a range of antecedents, outcomes and moderators.

Cross-sectional design

Given the cross-sectional design of the research, this research measures the respondents' perspective of their organisations at a point in time. This does not allow for the identification of trends over time (Creswell, 2012), whether this is change in the level of internal complexity leadership or contextual ambidexterity, or external changes in environmental dynamism.

Data analysis

The measurement instrument measured the observed variables on a Likert scale, coded as ordinal data. The constructs were then created by averaging the measures per scale, per respondent. Given the relatively small number of questions per variable (three in the case of environmental dynamism), this average could be misleading.

Regression analysis

During a multiple regression analysis, a range of assumptions are made about the relationships between the variables (Hair et al., 2010). Two of these assumptions were tested, normality and independence of the independent variables. The remaining two assumptions were automatically incorporated, and not confirmed: linearity of the relationship, and constant variance of the error terms (Hair et al., 2010). These assumptions are limitations.

4.9. Chapter conclusion

This chapter described the research methodology used to support or disprove the relationships hypothesised. The methodology selection was based on the nature of the research hypotheses and the relevant population and unit of analysis. The secondary data used was detailed, including the measurement scales used to measure the latent constructs. The preparation analysis was detailed and the results discussed. Given the reliability and validity of the scales used, the analysis used to support or disprove the hypothesis was detailed, of which the results are shown in the following chapter.

5. Results

The results obtained during the range of statistical analysis was performed, as detailed in the Chapter 4, is provided in this chapter. As an introduction, a few relevant descriptive statistics are detailed. Thereafter, the regression analysis results are provided per research objective and hypothesis. Finally, a few additional statistical analyses are detailed.

5.1. Descriptive statistics

5.1.1. Descriptive statistics: Biographical and control variables

The biographical information and control variables collected with the research instrument were used to determine certain basic descriptive statistics. Overall, the descriptive statistics confirmed that the sample obtained was demographically and biographically dispersed. This disparity is desired as the sample of responses represent a larger population (Creswell, 2012). A level of generalisation however remains when using a sample, an inherent limitation.

Organisational staff and middle management were most predominantly represented, with a total of 404 and 434 respondents respectively, as shown in Table 13 below.

Table 13 – Respondent organisational level

Respondent organisational level	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*

Further, the respondents represented nine (9) different internal organisational departments, and more than twenty (20) different industries in South Africa. The exploitative and exploratory efforts of organisation might differ given the organisation's age. This is due to the pressure that incumbents face to focus on exploitation (Benner & Tushman, 2015). Interestingly, 89.6% of the organisations represented were older than 10 years, as shown in Table 14.

Table 14 – Organisational age

Organisational age	Frequency	Percentage
Less than a year	3	0.2
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*

Complexity leadership incorporates leadership approaches for both the bureaucratic (operational) system, as well as the entrepreneurial system (Uhl-Bien et al., 2007). For this reason, the organisational type control variable (with options of 'bureaucratic' and 'entrepreneurial') is of particular interest. Although complexity leadership incorporates both systems in all organisations (Mendes et al., 2016), the respondents were required to indicate the most predominant. Interestingly, the number of bureaucratic and entrepreneurial organisations represented were similar, with 48.1%, and 51.9% represented respectively, as shown in Table 15 below.

Table 15 – Organisational type

Organisational type	Frequency	Percentage
Bureaucratic	579	48.1
Entrepreneurial	625	51.9
Total	*1204*	*100*

The size of the firm is of interest as smaller firms, with less hierarchical levels, have leadership that are more likely personally involved in exploitation and exploration efforts (Raisch & Birkinshaw, 2008). Further, Gibson and Birkinshaw (2004) argue that contextual ambidexterity is more appropriate in small organisations, or on a business unit level in larger organisations. Most of the organisations represented are relatively large and employed more than a thousand employees (52,9%), as shown in Table 16.

Table 16 – Organisational size

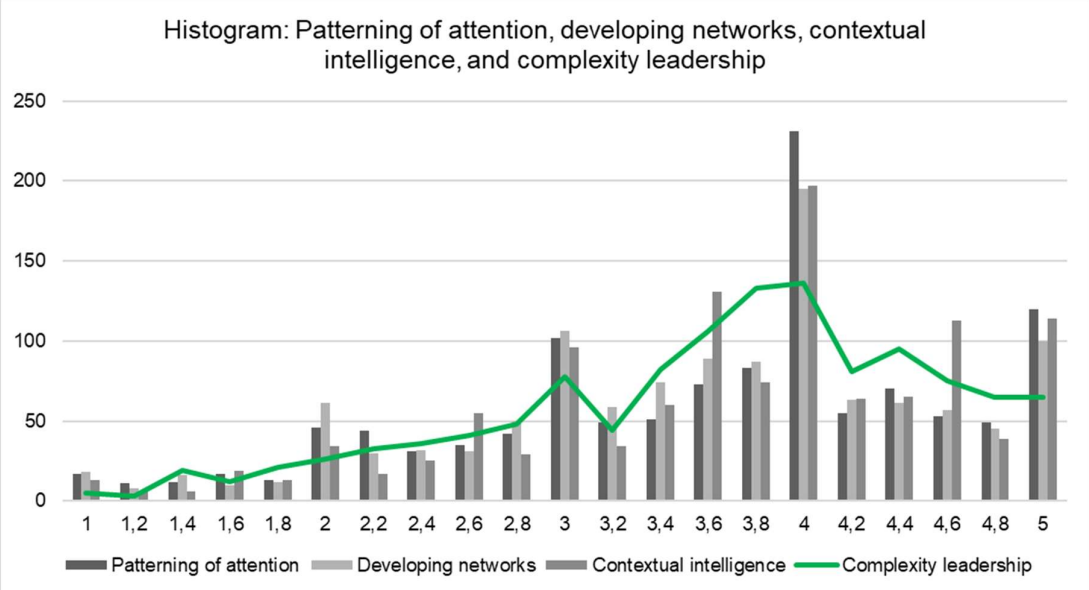
Organisational size	Frequency	Percentage
1-50 employees	66	5.5
51-100 employees	108	9.0
101-200 employees	74	6.1
201-500 employees	147	12.2
501-1000 employees	173	14.4
More than 1000 employees	636	52.8
Total	*1204*	*100*

5.1.2. Descriptive statics: Independent, dependent and moderator variables

Independent variable: Complexity leadership

Figure 14 below shows the histogram of patterning of attention, developing networks, contextual intelligence, and complexity leadership.

Figure 14 – Histogram: Patterning of attention, developing networks, contextual intelligence, and complexity leadership



From the histogram and basic descriptive statistics shown in
Table 37 in Appendix 4, the following conclusions could be drawn:

- The three sub-constructs of complexity leadership followed a similar pattern, but exceptions exist.
- The modes of 4 indicate that the respondents most often rated all three sub-

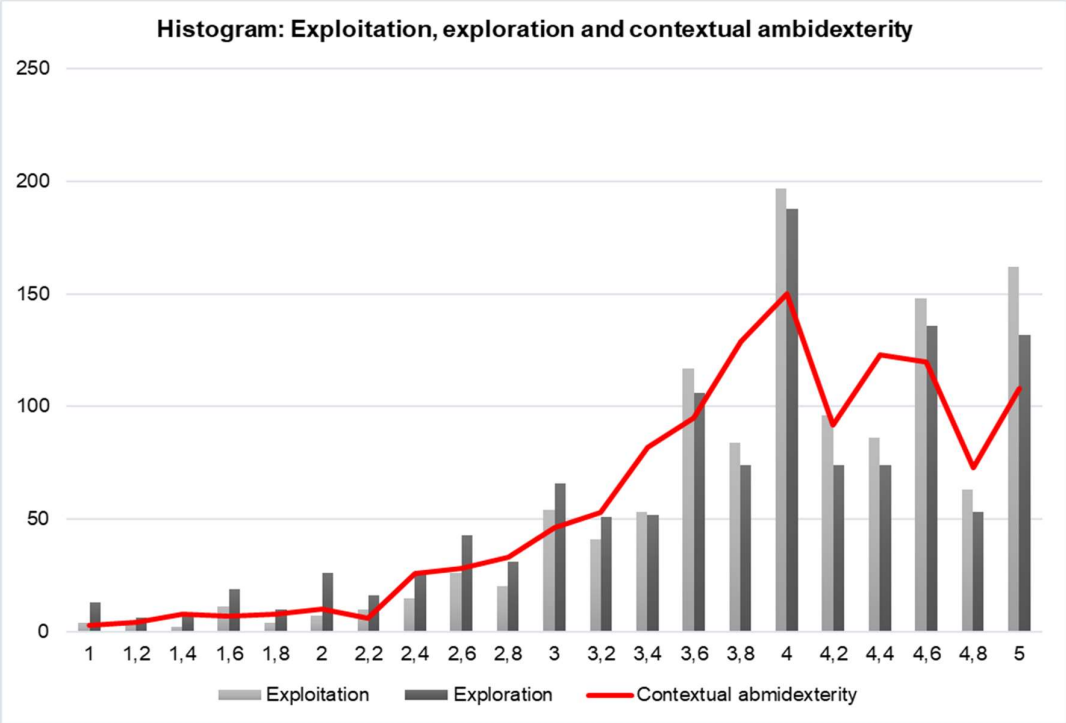
constructs' questions with 'Fairly often'.

- The average of the complexity leadership responses was 3.54.

Independent variables: Exploitation, exploration, and contextual ambidexterity

Figure 15 below shows the histogram of exploitation, exploration and contextual ambidexterity. It shows the frequency of responses between one and five.

Figure 15 – Histogram of exploitation, exploration and contextual ambidexterity responses

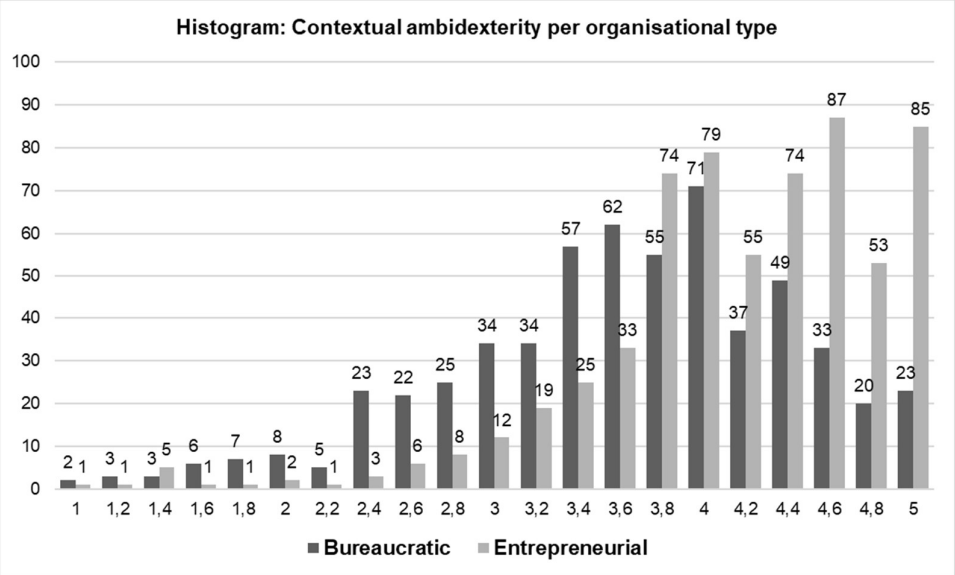


From the histogram, and basic descriptive statistics shown in Table 38 in Appendix 4, the following conclusions could be drawn:

- The exploitation and exploration responses had a similar pattern.
- The respondents rated the level of innovation in the organisations relatively high, with average responses of 3.91 for exploitation, 3.7 for exploration, and 3.81 contextual ambidexterity.
- The responses for exploration varied the most, with a standard deviation of 0.93, and a sample variance for 0.86.

The type of organisation was captured as a control variable: bureaucratic, or entrepreneurial. The difference in ambidexterity per organisational type was graphically investigated by drawing a histogram, shown in Figure 16.

Figure 16 – Histogram: CA per organisational type

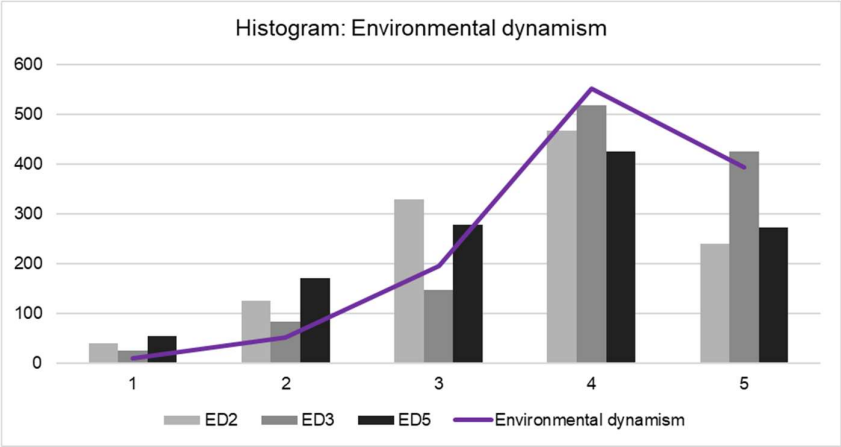


The number of responses from bureaucratic and entrepreneurial organisations where closely matched (48.1%, and 51.9% respectively). The histogram, however, revealed that respondents in entrepreneurial organisations rated their organisations higher on contextual ambidexterity, than the respondents at bureaucratic organisations. The average contextual ambidexterity rating of the bureaucratic organisation responses was 3.525, compared to an average rating of 4.072 for the entrepreneurial organisation responses.

Moderator variable: Environmental dynamism

Figure 17 below shows the histogram of environmental dynamism, against the frequency of the three scale questions.

Figure 17 – Histogram: Environmental dynamism



From the histogram and basic descriptive statistics shown in Table 39 in Appendix 4, the following conclusions could be drawn:

- The average of the environmental dynamism responses is 3.74, and the standard deviation 0.83.
- ED3 ("In our local market, changes are taking place continuously") was rated relatively highly, with a mean of 4.02, and a standard deviation of 0.98.
- The modes equal to 4 indicate that respondents most frequently rated all three questions (ED2, ED3 and ED5) with 'Somewhat agree'.

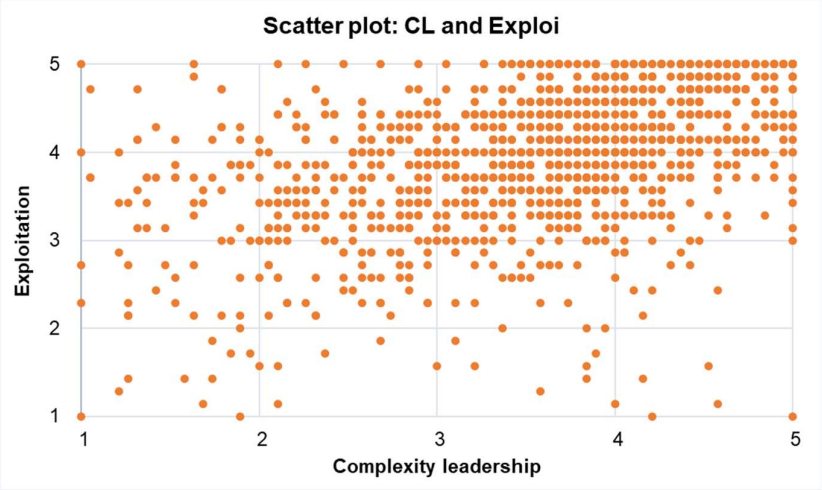
5.2. ***Objective 1***: Regression analysis

A regression analysis was run for each of the hypothesised relationships: complexity leadership and exploitation, complexity leadership and exploration, and finally, complexity leadership and contextual ambidexterity. For each analysis, the R^2 statistic is reported, along with the estimated coefficients and significance of the dependence relationship.

5.2.1. H1.1: Complexity leadership and exploitation

A basic scatterplot was drawn with complexity leadership on the x-axis, and exploitation on the y-axis, shown in Figure 18 below.

Figure 18 - H1.1 Scatter plot: CL and Exploi



From the scatter plot a positive linear relationship seems probable. The results of the regression analysis of complexity leadership and exploitation is shown in Table 17.

Table 17 – H1.1 Regression: CL and Exploi

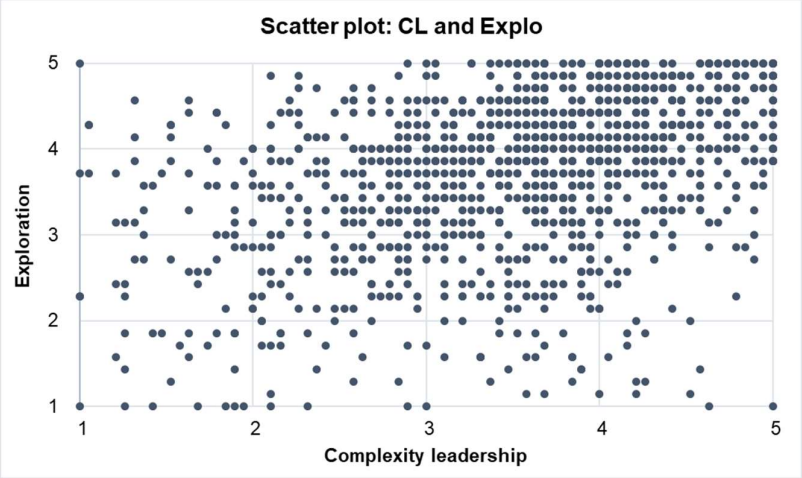
H 1.1 Regression: CL and Exploi	
R^2	0.198
Variables	**Coefficients**	**P-value**
Intercept	2.536	0.00
Complexity leadership	0.390	0.00

From this, it can be concluded that complexity leadership accounts for 19.8% of the variation in exploitation. The estimated coefficient of complexity leadership (b_{CL}) is 0.39, and is significant as the p-value is below 0.05.

5.2.2. H1.2: Complexity leadership and exploration

A basic scatterplot was drawn with complexity leadership on the x-axis, and exploration the y-axis, shown in Figure 19 below.

Figure 19 - H1.2 Scatter plot: CL and Explo



From the scatter plot a positive linear relationship seems probable. The results of the regression analysis of complexity leadership and exploitation is shown in Table 18 below.

Table 18 – H1.2 Regression: CL and Explo

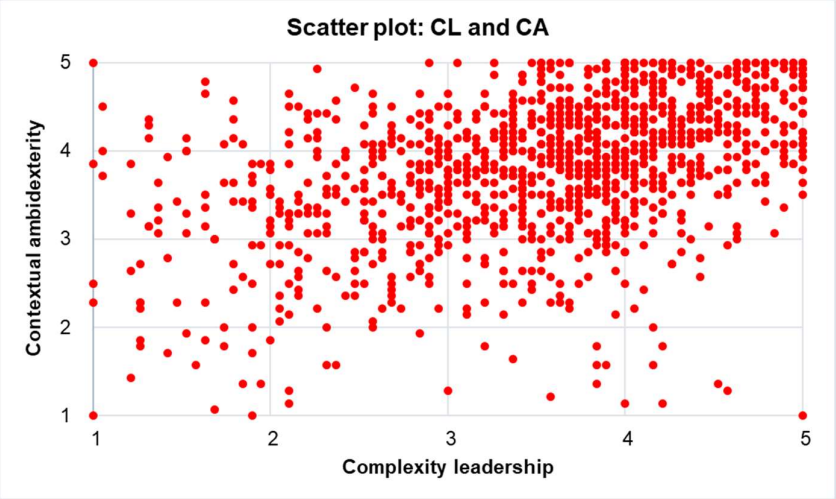
H 1.2 Regression: CL and Explo	
R^2	0.158
Variables	**Coefficients**	**P-value**
Intercept	2.246	0.00
Complexity leadership	0.412	0.00

From this it can be concluded that complexity leadership accounts for 15.8% of the variation in exploration. The estimated coefficient of complexity leadership (b_{CL}) is 0.412, and is significant as the p-value is below 0.05.

5.2.3. H1.3: Complexity leadership and contextual ambidexterity

A basic scatterplot was drawn with complexity leadership on the x-axis, and contextual ambidexterity on the y-axis, shown in Figure 20 below.

Figure 20 - H1.3 Scatter plot: CL and CA



From the scatter plot, a positive linear relationship seems probable. The results of the regression analysis of complexity leadership and contextual ambidexterity is shown in Table 19 below.

Table 19 – H1.3 Regression: CL and CA

H1.3 Regression: CL and CA		
R^2	0.205	
Variables	**Coefficients**	**P-value**
Intercept	2.391	0.000
Complexity leadership	0.401	0.000

From this, it can be concluded that complexity leadership accounts for 20.5% of the variation in contextual ambidexterity. The estimated coefficient of complexity leadership (b_{CL}) is 0.401, and is significant as the p-value is below 0.05.

5.3. *Objective 2:* Moderator multiple regression analysis

First, the multicollinearity between the predictor (independent) variables were investigated, thereafter the moderator regression analysis was performed to investigate objective 2.

5.3.1. Multicollinearity: Variance inflation factor and tolerance

The VIF and tolerance was calculated for the predictor variables: DL and ED, through a normal regression analysis in SPSS. The output from this analysis is shown in Table 20 below.

Table 20 – Multicollinearity statistics: VIF and tolerance

Independent variables	Collinearity Statistics	
	Tolerance	VIF
Complexity leadership	0.933	1.072
Environmental dynamism	0.933	1.072
Dependent Variable: Contextual ambidexterity		

Given the guideline criteria provided by Field (2014), the following conclusions could be drawn:

- The largest VIF was below 10 as both are 1.072;
- The average VIF is 1.072, which is not substantially above 1;
- The tolerances are both above 0.2.

From this, it could be determined that the level of multicollinearity is not problematic and the correlation between the predictors was not strong. With low collinearity, and the relationship between complexity leadership and exploitation, exploration, and contextual ambidexterity confirmed, the moderator effect on these relationships could be analysed.

5.3.2. H2.1: Environmental dynamism moderation on complexity leadership and exploitation

Table 21 shows the moderation regression model on exploitation. The model included environmental dynamism and complexity leadership as the independent variables, an interaction variable (denoted with int_1), and three control variables (organisational tenure, age and size).

Table 21 – H2.1 Moderation multiple regression model: Exploitation

H2.1 Moderation multiple regression model: Exploitation						
	Coeff	**se**	**t**	**p**	**LLCI**	**ULCI**
Constant	3.573	0.169	21.199	0.000	3.242	3.904
ED	0.401	0.030	13.208	0.000	0.341	0.460
CL	0.294	0.025	11.815	0.000	0.245	0.343
int_1	**0.014**	**0.031**	**0.446**	**0.656**	**-0.047**	**0.075**
OTenure	0.039	0.019	2.107	**0.035**	0.003	0.076
OAge	0.053	0.038	1.403	0.161	-0.021	0.127
OSize	-0.003	0.011	-0.263	0.792	-0.025	0.019

The R^2 of the regression was 0.366. The interaction effect coefficient is positive 0.014, however, this interaction was found to be non-significant as the p-value is 0.6558, greater than 0.05. From this, the researcher could conclude the moderating effect of environmental dynamism on the relationship between complexity leadership and exploitation is not significant.

In addition, the control variable organisational tenure was found to have a significant positive influence on exploitation, with a p-value of 0.035 (below 0.05). Given the estimated coefficient, if organisational tenure increases by one standard deviation, exploitation will also increase by 0.039 of its own standard deviation. The remaining two control variables, organisational age and size, were not found to have a significant influence on exploitation as these variables obtained a p-value above 0.05.

5.3.3. H2.2: Environmental dynamism moderation on complexity leadership and exploration

Table 22 shows the moderation regression model, on exploration. The model included environmental dynamism and complexity leadership as the independent variables, an interaction variable (denoted with int_1), and three control variables (organisational tenure, age and size).

Table 22 – H2.2 Moderation multiple regression model: Exploration

H2.2 Moderation multiple regression model: Exploration						
	Coeff	**se**	**t**	**p**	**LLCI**	**ULCI**
Constant	3.771	0.144	26.194	0.000	3.488	4.053
ED	0.548	0.030	18.057	0.000	0.488	0.608
CL	0.282	0.027	10.583	0.000	0.223	0.334
int_1	**0.011**	**0.027**	**0.399**	**0.690**	**-0.042**	**0.064**
OTenure	0.040	0.021	1.883	0.060	-0.001	0.082
OAge	-0.046	0.036	-1.264	0.207	-0.116	0.025
OSize	0.011	0.015	0.723	0.470	-0.018	0.039

The R^2 of the regression was 0.382. The interaction effect coefficient is 0.0107, however, this interaction was found to be non-significant as the p-value is 0.690, greater than 0.05. From this, the researcher could conclude the positive moderating effect of environmental dynamism on the relationship between complexity leadership and exploration is not significant.

In addition, none of the control variables were found to have a significant influence on exploration as all these variables obtained a p-value above 0.05.

5.3.4. H2.3: Environmental dynamism moderation on complexity leadership and contextual ambidexterity

With the above moderator relationships proven to be non-significant, the moderator effect of the combined construct, contextual ambidexterity was tested. Lavie et al. (2010) advocated the use of a single variable to capture exploration and exploitation. Furthermore, in a similar study, Gibson and Birkinshaw (2004) combined the measures for exploitation and exploration, to represent contextual ambidexterity. The moderator analysis results for contextual ambidexterity are shown in Table 23.

Table 23 – H2.3 Moderation multiple regression model: Contextual ambidexterity

H2.3 Moderation multiple regression model: Contextual ambidexterity						
Model summary	R	R-sq	F	Df1	Df2	p
	0.658	**0.433**	277.066	3.000	1200.000	0.000
	Coeff	**se**	**t**	**p**	**LLCI**	**ULCI**
Constant	3.807	0.019	200.396	0.000	3.77	3.844
ED	0.474	0.028	17.142	0.000	0.42	0.528
CL	0.289	0.023	12.49	0.000	0.243	0.334
int_1	**0.012**	**0.026**	**0.4514**	**0.652**	**-0.04**	**0.064**

The R^2 of the model was above the required minimum level of 0.01, and was statistically significant. The interaction effect for contextual ambidexterity is 0.0119. However, this interaction is non-significant as the p-value is 0.6518, greater than 0.05. From this, the researcher could conclude the positive moderating effect of environmental dynamism on the relationship between complexity leadership and contextual ambidexterity is not significant.

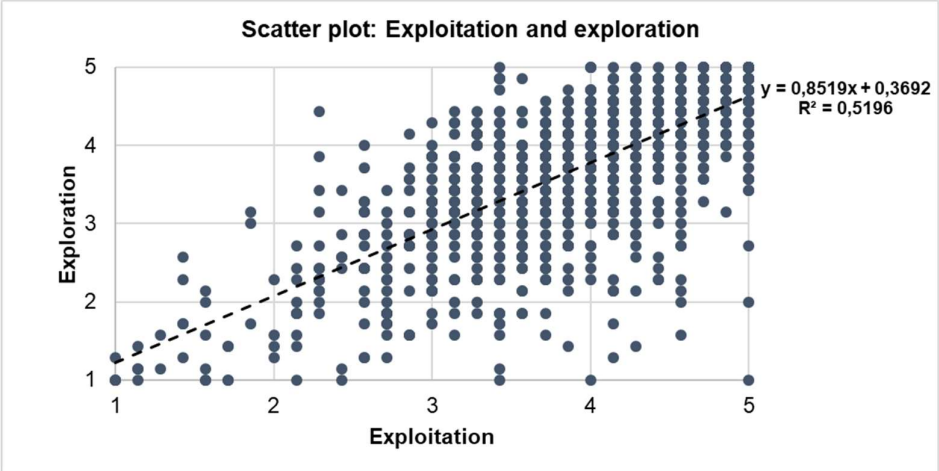
5.4. Additional analyses

Throughout the statistical analysis of this research, a few unexpected results were obtained. To ensure thorough understanding of these findings, a few additional analyses were performed.

5.4.1. Relationship between exploitation and exploration

The discriminant validity correlation analysis provided indicated a strong correlation between exploitation and exploration. Although not part of the conceptualised model, this relationship was investigated further. A practical first step to summarise the relationship between the two variables is to draw a simple scatter plot diagram of the two continuous variables, and to add a regression line (Field, 2014). In Figure 21 exploitation is taken as the independent variable on the x-axis, and exploration as the dependent variable on the y-axis. Visually a positive linear correlation seems probable, as indicated by the regression line statistics.

Figure 21 - Scatter plot: Exploi and Explo



To determine the significance of the linear relationship between these variables, a simple linear regression was performed, with exploitation as the independent variable, and exploration the dependent variable. Given that there was no theoretical basis for this relationship, the independent and dependent variables were not easily indefinable. As a result, the simple linear regression analysis was performed twice, first with exploitation as the independent variable, and exploration the dependent variable. The results of the analysis are shown in Table 24 below.

Table 24 – Regression: Exploi and Explo

Regression: Exploi and Explo		
R^2	0.520	
Variables	**Coefficients**	**P-value**
Intercept	0.369	0.00
Exploitation	0.852	0.00

From this, it can be concluded that exploitation accounts for 52% of the variation in exploration. The estimated coefficient of exploitation (b_{Exploi}) is 0.852, and is significant as the p-value is below 0.05. The linear equation matches the regression line, stated as:

$$Explo = 0.369 + 0.852 \times Exploi$$

Given the estimated coefficient, if exploitation increases by one standard deviation, exploration will also increase by 0,852 of its own standard deviation.

As a cross-check, the simple linear regression was run a second time, now with exploration as the independent variable, and exploitation the dependent variable. The results obtained were similar, as shown in Table 25 below.

Table 25 – Regression: Explo and Exploi

Regression: Explo and Exploi		
R^2	0.520	
Variables	**Coefficients**	**P-value**
Intercept	1.665	0.00
Exploration	0.610	0.00

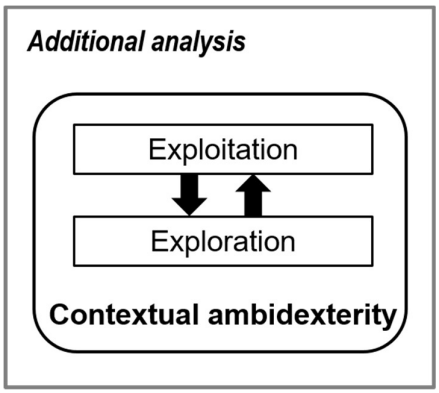
From this, it can be concluded that exploitation accounts for 52% of the variation in exploration. The estimated coefficient of exploitation (b_{Explo}) is 0.61, and is significant as the p-value is below 0.05. The linear equation matches the regression line, stated as:

$$Exploi = 1.665 + 0.61 \times Explo$$

Given the estimated coefficient, if exploitation increases by one standard deviation, exploration will also increase by 0.61 of its own standard deviation.

As a result, it can be concluded that exploitation and exploration have a strong positive, linear, relationship. This relationship is conceptualised in Figure 22 below.

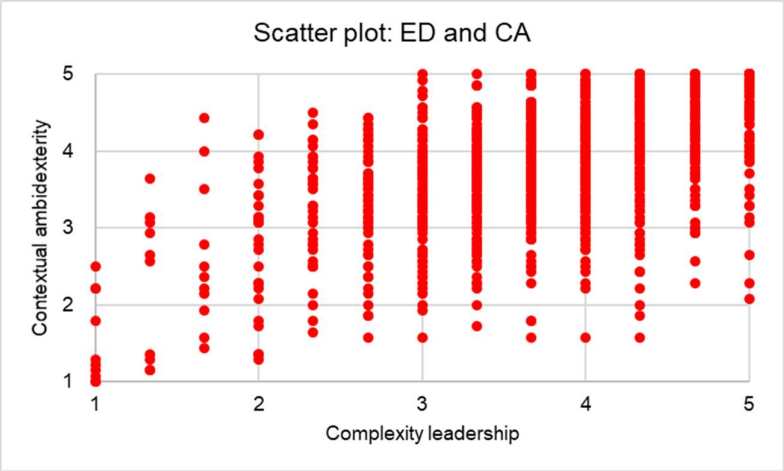
Figure 22 – CA: Exploi and Explo



5.4.2. Environmental dynamism direct influence on contextual ambidexterity

Interestingly, the moderator multiple regression indicates environmental dynamism itself has a significant positive linear relation with contextual ambidexterity. This was further investigated with a simple linear regression analysis, as before. The scatter plot of environmental dynamism and contextual ambidexterity is shown in Figure 23.

Figure 23 – Scatter plot: ED and CA



From the scatter plot, a positive linear relationship seems probable. The simple linear regression was performed, now with environmental dynamism as the independent variable, and contextual ambidexterity the dependent variable. The results of the analysis are shown in Table 26 below.

Table 26 – Regression: ED and CA

Regression: ED and CA		
R^2	0.334	
Variables	**Coefficients**	**P-value**
Intercept	1.746	0.00
Environmental dynamism	0.552	0.00

From this, it can be concluded that environmental dynamism accounts for 33.4% of the variation in contextual ambidexterity. The estimated coefficient of environmental dynamism (b_{ED}) is 0.552, and is significant as the p-value is below 0.05.

5.5. Chapter conclusion

Descriptive statistics provided insight into the respondents, as well as the behaviour of the independent, dependent, and moderator variables. a simple linear regression was used to investigate the first objective of this research. A moderator multiple regression analysis was thereafter used to investigate the second objective of this research. The following chapter describes the relevancy of the results obtained in this chapter.

6. Discussion of results

In Chapter 5, a range of statistical analyses have been performed on the secondary data received. This chapter describes the relevance of the results obtained, with specific reference to the literature reviewed and the research objectives. An overview of the results to be discussed in shown in Figure 24 below.

Figure 24 – Summary of results obtained

Reliability and validity of instrument	**Descriptive statistics**	***Objective 1:*** **Regression analysis**	***Objective 2:*** **Moderator multiple regression**
• Data prepared • Reliability of scales confirmed • Convergent validity confirmed through exploratory factor analysis • Discriminant validity confirmed through correlation	• Provided insight into the responses according to biographical and control variables, as well as the independent, dependent and moderator variables	• Supported H1.1, H1.2, and H1.3. CL has a significant, positive, linear relationship with Exploi, Explo, and CA	• Disproved H2.1, H2.2 and H2.3. ED has no significant moderator effect on the relationship between CL and Exploi, Explo, and CA.

6.1. Reliability and validity of instrument

The appropriateness of the scales were assessed through a series of reliability and validity tests: Cronbach's alpha, Exploratory Factor Analysis (convergent validity) and correlation analysis (discriminant validity). The EFA provided valuable insights concerning the scales used and the relationships between the observed variables. The correlation analysis provided insights with regards to the associations between the latent variables.

6.1.1. Convergent validity of complexity leadership scales

The scales used to measure patterning of attention and developing networks was first developed by Osborn and Strictstein (1985) in "Measures of strategic leadership in the U.S and Japan". Since its inception, it has been utilised by other scholars, has shown high reliabilities, and has been proven to be a valid measure of these two sub-constructs. In applications such as that of Osborn and Marion (2009) it was utilised to measure the constructs themselves. This research was the first to group these two constructs, along with a measure of contextual intelligence, to establish a high-level construct of complexity leadership.

Further, the 12 behaviours and skills identified by Kutz (2008) could not all be included in the survey, as this could have increased the survey length and the possibility of

missing values. The seven items selected form the 12, shown in Table 35 in Appendix 3, were selected by the secondary data researcher on the basis of conceptual knowledge. The EFA has proven that these seven items are all relevant in measuring complexity leadership.

Complexity leadership in itself does not have known measurement scales as yet. The exploratory factor analysis confirmed that the scales for these three sub-constructs all load onto complexity leadership, and should be considered as one factor. Conceptually, the scale has been developed and its reliability proven.

6.1.2. Environmental dynamism scales

The five-item measure for environmental dynamism, developed by Jansen et al. (2006) was used. Jansen et al. (2006) calculated a Cronbach's alpha of 0.87 for this scale, and established that it expressed both the rate of change and the instability of the external environment. This research, conducted in a South African context, achieved a lower Cronbach's alpha of 0.694. This coefficient was increased to 0.716 by removing two questions in the scale; "Environmental changes in our local market are intense" (ED1), and the reverse stated "In a year, nothing has changed in our market" (ED4).

The poor reliability of ED4 could be attributed to the reverse writing style. Where all the other environmental dynamism questions were stated in a positive light, with "strongly agree" indicating a high level of dynamism, this question was reversed. The answers were inversed before the analysis was performed. It is, however, possible that the respondents misunderstood the question in light of the accompanying questions. This could have reduced the internal consistency of responses, analysed by the Cronbach's alpha (Creswell, 2012).

The difference in the internal consistency could also have been influenced by the sample. To measure environmental dynamism, Jansen et al. (2006) sampled 462 organisational unit managers, in autonomous branches of a single large financial services firm. From this, a few differences are probable:

- A unit manager's understanding of the questions in the scale could be different from that of the range of respondents sampled in this survey, 33.6% of which was lower level staff.
- The perspective from a single firm, in a single industry, is limited. This research included many organisations, in more than 19 different industries.

In conclusion, the lower Cronbach's alpha obtained for the environmental dynamism

scale, as well as the need to remove two of the scale items, could be attributed to the research design. The exploratory factor analysis did confirm the items all load onto one construct, and a Cronbach alpha of 0.716 was obtained, which is above the minimum satisfactory level of 0.6 (Creswell, 2012). Thus, environmental dynamism was sufficiently measured by the scale items.

6.2. Descriptive statistics

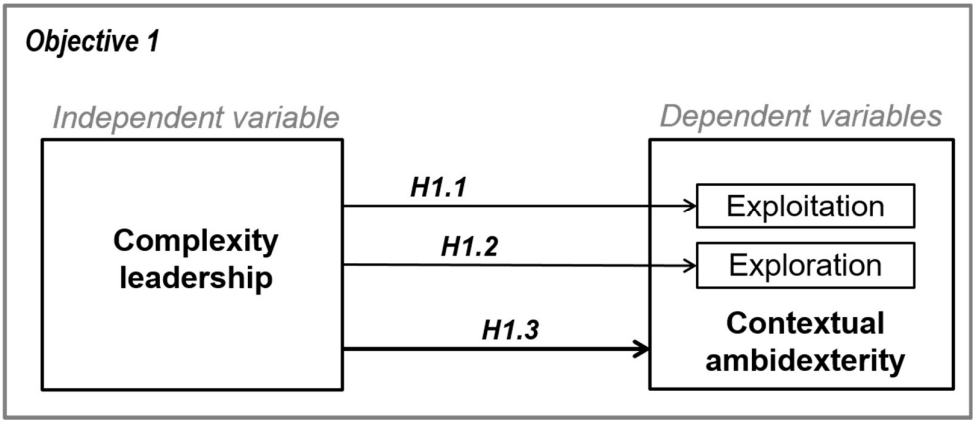
Although not part of the focus of this research, the descriptive statistics considered did yield a few results that were found to be noteworthy:

- The majority of respondents were staff and middle management. As a result, the complexity leadership measured would be organisation-wide, not only top (executive) management focused. This supported to the research's aim to incorporate contextual ambidexterity across all three of the different organisational levels, as defined by Carter (2015).
- Respondents rated the level of exploitation, with an average of 3.91, higher than the level of exploration, with an average of 3.7. This is understandable, as organisations prefer exploitation above exploration (Jansen et al., 2009; March, 1991). Overall, the average rating for contextual ambidexterity was relatively high, with an average of 3.81. This indicates that respondents view their organisations as innovative, promoting both exploitation and exploration. In addition, most of the organisations represented (89.6%) are older than ten years. This supports the concept that organisational ambidexterity is a prerequisite for organisational success and survival (Raisch & Birkinshaw, 2008), as the organisations were rated relatively high on the level of innovation, and have survived more than ten years.
- The majority of responses were from relatively large organisation (with more than 1 000 employees), however, 51.9% of the respondents indicated that their organisations are entrepreneurial. This is unexpected as Benner and Tushman (2015, p.499) stated "the tension faced by incumbents is that exploitative innovation drives out exploratory innovation". Large incumbent organisations often become exploitation focused, at the cost of exploration.
- The average contextual ambidexterity rating of the bureaucratic organisation responses was 3.525, compared to an average rating of 4.072 for the entrepreneurial organisation responses. It is probable that the respondents inherently joined the perception of an innovative organisation, that is promoting both exploitation and exploration, with an entrepreneurial organisation.

6.3. *Objective 1*: Regression analysis

To investigate objective 1, as shown in Figure 25 below, a simple linear regression analysis was used. First the relationship between complexity leadership and exploitation and exploration was investigated and thereafter, the relationship between complexity leadership and contextual ambidexterity.

Figure 25 – Objective 1



6.3.1. H1.1 and H1.2: Complexity leadership and exploitation, and exploration

The p-values from the regression analysis were both below 0.05. As a result, both null-hypotheses of Hypotheses H1.1 and H1.2 were rejected. Thus, it can be concluded that the overall fit of the model was significant and the alternate hypotheses were confirmed, detailed in Table 27 below.

Table 27 – H1.1 and H1.2: Conclusions from Regression analysis

Objective 1	Conclusion from alternate hypothesis, R^2, and regression coefficient
Hypothesis H1.1	• A significant positive linear relationship exists between complexity leadership and exploitation. • Complexity leadership accounts for 19.8% of the variation in exploitation. • The linear regression equation can be stated as: $$Exploi = 2{,}536 + 0.39 \times CL$$ • Given the estimated coefficient, if complexity leadership increases by one standard deviation, exploitation will also increase by 0,390 of its own standard deviation.

Hypothesis H1.2	• A significant positive linear relationship exists between complexity leadership and exploration. • Complexity leadership accounts for 15.8% of the variation in exploration. • The linear regression equation can be stated as: $$Explo = 2{,}246 + 0.412 \times CL$$ • Given the estimated coefficient, if complexity leadership increases by one standard deviation, exploitation will also increase by 0,412 of its own standard deviation.

These findings build on those of Jansen et al. (2009). Jansen et al. (2009) found that transformational leadership has a significant positive linear relationship with exploration; also, transactional leadership has a significant positive linear relationship with exploitation. For this reason, Jansen et al. (2009) argue that both types of leadership would be required for strategic leadership.

Nonetheless, the contradiction remained. Transactional leadership has a significant negative influence on exploration, and transformational leadership behaviours are not associated with exploitation (Jansen et al., 2009). This is because transformational leadership does not adequately consider the organisational processes, and transactional leadership discourages efforts that depart from existing capabilities and status quo (Jansen et al., 2009). From this Jansen et al. (2009) further remarked that the central tenet of strategic leaders, that is, adopting different leadership styles to facilitate organisation-level exploitation and exploration, remains unclear. This research now established that a specific leadership style does promote both exploitation and exploration: complexity leadership.

Uhl-Bien et al. (2007) developed Complexity Leadership Theory to address the requirement to balance both types of leadership. Uhl-Bien et al. (2007, p.304) stated that “it seeks to integrate… exploration and exploitation”. Interestingly, it does not focus the leadership influence on either type of innovation separately.

Complexity leadership and exploitation

From this, it can be concluded that complexity leadership would drive exploitation, the refining and extending of existing paradigms (March, 1991). Complexity leadership seeks to foster appropriate organisational bureaucracy, which ensures controlled coordination and exploitation (Uhl-Bien et al., 2007). It requires an operational leader to drive the operational system, and enhance organisational performance and fitness (Uhl-

Bien & Arena, 2017). These leadership activities are based in the more traditional managerial activities, with formal coordination and planning (Mendes et al., 2016).

In summary, complexity leadership has a significant positive influence on the level of exploitation in the organisation. Utilising the overarching complexity leader approach and behaviours, such as patterning of attention, developing networks and contextual intelligence, would promote exploitation in an organisation.

Complexity leadership and exploration

In addition, complexity leadership would drive exploration, which focuses on competences and technologies; and is experimental in nature, discovering new alternatives (March, 1991). Complexity leadership seeks to foster complex adaptive system dynamics, which enables informal emergence and exploration (Uhl-Bien et al., 2007). These leadership activities are more adaptive, informal and dynamic than traditional management activities (Mendes et al., 2016).

In summary, complexity leadership has a significant positive influence on the level of exploration in the organisation. Utilising the overarching complexity leader approach and behaviours, such as patterning of attention, developing networks and contextual intelligence, would promote exploration in an organisation.

6.3.2. H1.3: Complexity leadership and contextual ambidexterity

Given the results of Hypotheses H1.1 and H1.2 confirmed that complexity leadership has a significant linear influence of exploitation, as well as exploration, it could be feasibly expected that it would also have a significant linear influence on the combined construct contextual ambidexterity. The p-value from the regression analysis was below 0.05. As a result, all null-hypothesis of Hypothesis H1.3 were rejected. This concludes that the overall fit of the model was significant and the alternate hypotheses were confirmed, detailed in Table 28 below.

Table 28 - H1.3: Conclusions from Regression analysis

Objective 1	**Conclusion from alternate hypothesis, R^2, and regression coefficient**
Hypothesis H1.3	• A significant linear relationship exists between complexity leadership and contextual ambidexterity. • Complexity leadership accounts for 20.5% of the variation in contextual ambidexterity. • The linear regression equation can be stated as:

	$$CA = 2.391 + 0.401 \times CL$$ • Given the estimated coefficient, if complexity leadership increases by one standard deviation, contextual ambidexterity will also increase by 0,401 of its own standard deviation.

Conceptually, pursuing both exploitation and exploration, impose considerable challenge to leadership, as different leadership behaviours are required (Jansen et al., 2009). A complexity leadership approach can assist with this challenge as it can be conceptualised as the overarching framework of the operational (exploitive) and entrepreneurial (exploration) system, and the adaptive space between these systems (Uhl-Bien & Arena, 2017). It incorporates the concept of enabling leadership, with the goal to create an adaptive space (interface) between the operational and entrepreneurial systems (Mendes et al., 2016). This complex adaptive system has the unique ability to rapidly, and creatively adapt to environmental changes, to address internal tensions (Uhl-Bien et al., 2007). This is crucial as the contradictions and conflicting demands of exploitation and exploration, lead to internal tensions (Raisch & Birkinshaw, 2008). Contextual ambidexterity is made possible by reconciling these tensions.

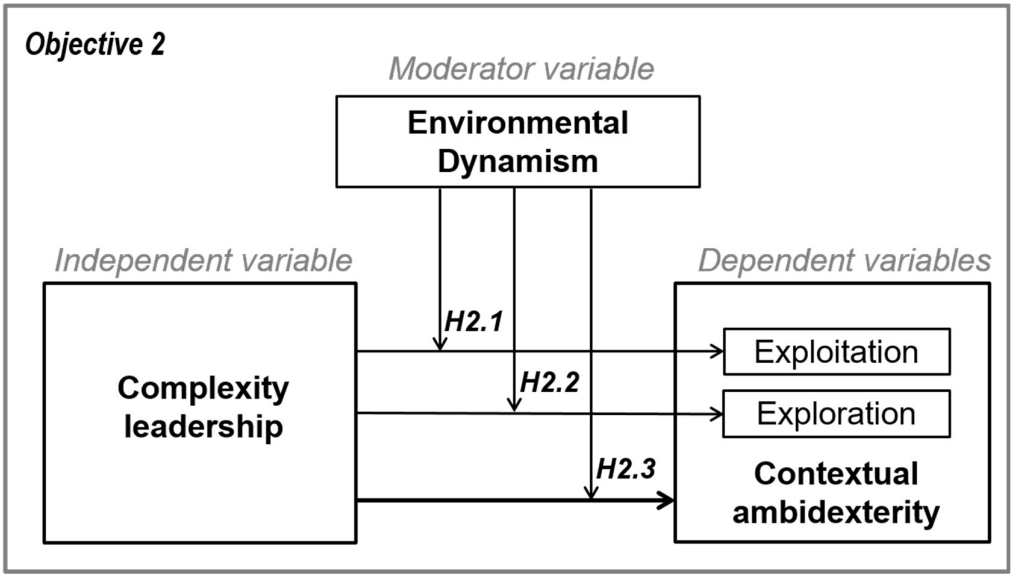
A broader understanding of the dynamics of contextual ambidexterity is required. This is supported by the recent movement of leadership development practices toward a relational and systemic perspective, incorporating ideas and concepts from complexity science (Clarke, 2013), addressing the complexities of organisations in the Knowledge Era (Uhl-Bien et al., 2007). Thus, if leaders apply a complexity leadership approach, as measured by three behaviours (patterning of attention, developing networks, and contextual intelligence), an adaptive space can be established, that addresses the internal complexities in such a way that it drives contextual ambidexterity.

Thus, complexity leadership processes and behaviours drive contextual ambidexterity. This is an important finding for two reasons. Firstly, imbedding contextual ambidexterity to integrate exploitation and exploration (Nemanich & Vera, 2009), is considered a requirement for an organisation to remain competitive (De Clercq et al., 2014). Secondly, organisation only exhibit ambidexterity when leaders purposefully aim to simultaneously improve the current operations, and implement breakthrough ideas to expand (De Clercq et al., 2014; Gibson & Birkinshaw, 2004). Leadership must consciously drive contextual ambidexterity to ensure organisational competitiveness, and can focus on developing behaviours such as patterning of attention, network development, and contextual intelligence.

6.4. *Objective 2*: Multiple regression

To investigate objective two, as shown in Figure 26 below, a moderator multilinear regression was used and the moderator effect of environmental dynamism on the relationship between complexity leadership and exploitation, exploration, and finally contextual ambidexterity, was analysed.

Figure 26 – Objective 2



Multiple regression provides insights into the relative importance of predictors, their relationships with the dependent variable (Hair et al., 2010). The moderator multiple regression included three control variables (tenure at organisation; organisational age and size), complexity leadership, environmental dynamism and the interaction term.

The p-values of the interaction terms, in all three of the multiple regression analyses were above 0.05. As a result, all three null-hypotheses of Hypotheses H2.1, H2.2 and H2.3 could not be rejected, detailed in Table 29 below

Table 29 – H2.1, H2.2 and H2.3: Conclusion from moderator multiple regression analysis

Objective 2	Conclusion from alternate hypothesis, R^2, and regression coefficient
Hypothesis H2.1	The p-value obtained was 0.656, which is above the threshold of 0.05. Environmental dynamism does not have a significant moderator effect on the relationship between complexity leadership and exploitation.
Hypothesis H2.2	The p-value obtained was 0.690, which is above the threshold of 0.05. Environmental dynamism does not have a significant moderator effect on the relationship between complexity leadership and exploration.

Hypothesis H2.3	The p-value obtained was 0.652, which is above the threshold of 0.05. Environmental dynamism does not have a significant moderator effect on the relationship between complexity leadership and contextual ambidexterity.

From this, environmental dynamism does not have a significant moderating effect on the relationships between complexity leadership and exploitation, exploration, and the combined construct contextual ambidexterity. Research objective 2 was shown not to be valid.

It was expected that environmental dynamism moderates the leadership's efforts of exploit and explore. The effectiveness of exploitation and exploration is moderated by environmental dynamism (Jansen et al., 2006) and leadership aims to drive effective exploitation and exploration. However, with no moderator influence from environmental dynamism, Jansen et al. (2009, p.15) concluded that the "relationships are always internally consistent, independent of environmental conditions". The following section explores the possible reason for this finding: the research design and approach, the emergent nature of the concepts, the assumptions made within complexity leadership theory, the highly rated environmental dynamism, and, lastly, the unexpected effect of a control variable (organisational tenure).

Research design and approach

The moderator effect of environmental dynamism on the relationship between complexity leadership and exploitation, exploration, and the combined construct contextual ambidexterity, was based on the literature reviewed by Raisch and Birkinshaw (2008), and particularly the empirical findings of Jansen et al. (2009). Jansen et al. (2009) proved that the relationship between transactional leadership and exploitative innovation is significantly, negatively moderated by the level environmental dynamism, as summarised in Figure 32 in Appendix 1. It argued that the environmental dynamism should be taken into account when considering the effectiveness of leadership's drive for exploitation and exploration.

The research design differences between this research and of that conducted by Jansen et al. (2009) are substantial. A few particular research design differences are noteworthy:

- This research surveyed a range of respondents from across South African organisations, in contrast Jansen et al. (2009) that only investigated a specific, large, financial services organisation.
- This research incorporated the complexity leadership at all levels of the

organisation, where Jansen et al. (2009) focused on top-management's transformation and transactional leadership styles.

- This research was conducted in a South African context, whereas Jansen et al. (2009) collected responses in a European country.

The differences in country context are stark and could have contributed to the differences in findings. Developing countries, such as South Africa, are commonly known for unstable and bureaucratic business environments (Adomako & Danso, 2014), in contrast to a more stable environment in developed economies. The dynamic environments of emergent economies tend to foster innovative behaviour (Adomako & Danso, 2014), which would influence the exploitation and exploration efforts. Overall, little empirical work has examined the influence of environmental dynamism on less developed markets (Adomako & Danso, 2014).

Assessment of an emergent concept

It should be noted that there is little substantive research around complexity leadership. Avolio et al. (2009) suspected that this is due to the difficulties in assessing an emergent construct such as this, within dynamically changing contexts. The researcher found that the sub-construct scales used to evaluate complexity leadership together did measure a construct. The respondents' perceptions of this emerging concept, in a dynamically changing context, is however difficult to determine.

Complexity leadership assumptions

Clarke (2013) explains that complexity leadership makes a few important assumptions about the nature of the complex organisational context. Firstly, complexity leadership assumes that the organisation is an open system (Clarke, 2013). The scales of both developing networks and contextual intelligence acknowledges the direct link between the organisation and its context. For example, DN1 asked whether the leader *"creates linkages between entities inside the organisation and with outside stakeholders*", and CI2 asked whether the leader "*demonstrates being in tune with the organisational and external environment or context".* This would challenge the concept of measuring environmental dynamism as a separate, external construct.

Secondly, complexity leadership assumes an organisation is a complex adaptive system. This assumption does not allow a researcher to simply break down the organisation into interacting components, as the interactions within the system, and the interaction with its context, give rise to unforeseen and unpredictable responses (Clarke, 2013). The organisation experiences a range of interactions with its context, and simplifying this to

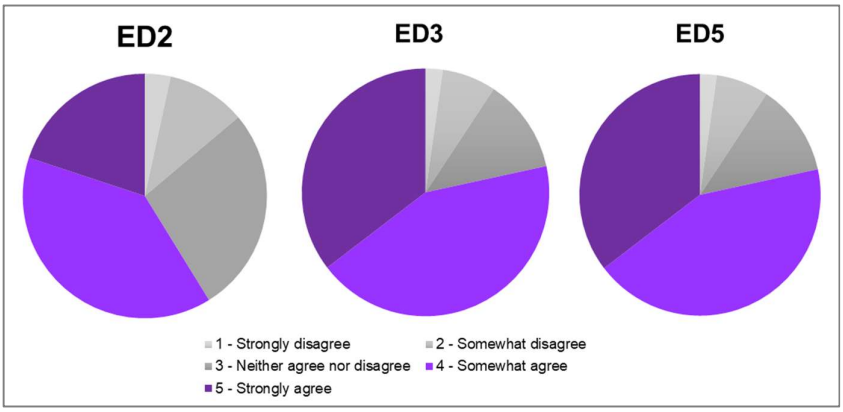
the concept of environmental dynamism could be misguided.

Uhl-Bien and Arena (2017) explained that, in today's environment, complexity occurs on many levels, as a result of increased interconnectivity. The environment's complexity increases the number of variables that leaders need to consider.

Environmental dynamism measured

Respondents rated the environmental dynamism or their organisations as relatively high. Figure 27 below depicts the distribution of responses graphically, per question. Most respondents answered these three questions with 'Strongly agree', and 'Somewhat agree' (with the mode of all three questions 'Somewhat agree').

Figure 27 – Environmental dynamism responses



From this it is evident that employees, in South African organisations, represented by the sample collected, view the task environment as dynamic. It indicates that there is an accelerated rate of change (Terreberry, 1968), absence of pattern, and unpredictability in the environment (Dess & Beard, 1984), which increases the uncertainty decision makers face (Duncan, 1972). The perception of a dynamic environment is confirmed in literature, with scholars such as Daft (2016) that state that all organisations face tremendous uncertainty as environments are increasingly dynamic.

The consciences among the respondents that the environment is dynamic, does not discredit the role of the overall context. Leadership is contextualised (Hannah et al., 2009). With the dynamic perspective proposed by complexity theory, leaders are themselves adapting to the complexity of the environment, and have an important role in enabling contextual ambidexterity (Havermans et al., 2015). Leadership needs to ensure that the complexities of the context, is addressed. However, complexity leadership suggests that an organisation's simple, rationalised structure underestimates

the complexity of the context in which the organisation functions (exploit) and adapts (explore) (Avolio et al., 2009). From this, it is evident that the dynamics of the context does influence the leader, and the efforts to drive innovation, and ambidexterity.

Control variables: Organisational tenure

Three control variables (organisational tenure, organisational age, and organisational size) were included in the multiple regression analyses. Overall, the influence of these variables on the dependent variables (exploitation, exploration, and contextual ambidexterity) were found to not be significant, with the exception of organisational tenure and exploitation. It was found that organisational tenure has a significant positive influence on exploitation. This indicates that employees that have been with an organisation for longer increased the perceived level of exploitation of that organisation. The duration of employment does probably not influence the level of exploitation, but this finding does show how the employee perspective regarding the level of innovation is potentially distorted.

6.5. Additional analyses

Throughout the statistical analysis of this research a few unexpected results were obtained, which were further analysed to ensure thorough understanding.

6.5.1. Relationship between exploitation and exploration

A discriminant validity concern was found between exploitation and exploration. There existed a significant positive correlation between exploitation and exploration, with a correlation coefficient of 0.816. Thus, exploitation and exploration has a strong linear associated, as measured through a correlation analysis (Hair et al., 2010; Wegner, 2016). Two simple linear regression analyses were performed to investigate this relationship further, with the results shown in Table 30.

Table 30 - Regression results: Exploitation, exploration

Additional analyses	Conclusion from R^2, and regression coefficient
Exploitation and exploration	• A significant linear relationship exists between exploitation and exploration, which accounts for 52% of the variation in exploration. • The linear regression equation can be stated as: $$Explo = 0.369 + 0.852 \times Exploi$$ • Given the estimated coefficient, if exploitation increases by one

	standard deviation, exploration will also increase by 0.852 of its own standard deviation.
Exploration and exploitation	• A significant linear relationship exists between exploration and exploitation, which accounts for 52% of the variation in exploitation. • The linear regression equation can be stated as: $$Exploi = 1.665 + 0.61 \times Explo$$ • Given the estimated coefficient, if exploration increases by one standard deviation, exploitation will also increase by 0.61 of its own standard deviation.

From this, if organisations improve the level of exploitation innovation, it would also improve the level of exploration innovation, and visa-versa. From the literature, the researcher found both confirmations and contradictions to this argument.

Support for this finding

From this analysis, it is evident that these two forms of innovation cannot be separated. This is consistent with the literature on organisational ambidexterity, particularly contextual ambidexterity. Scholars have identified this strong relationship, and developed the concept from different research streams, including organisational learning, strategic management, technological innovation and organisational adaptation and design (Raisch & Birkinshaw, 2008). In summary, exploitation and exploration are interrelated (De Clercq et al., 2014), and even considered inseparable (Floyd & Lane, 2000).

Practically, ambidextrous organisations do exist. These organisations have the ability to simultaneously pursue both exploitation and exploration (Jansen et al., 2006; Tushman and O'Reilly, 1996). It has even been argued that having this ability to exploit and explore is a prerequisite of organisational survival and success (Raisch & Birkinshaw, 2008). If leadership aim to promote organisational innovation, an ambidexterity perspective is required, promoting both exploitation and exploration.

Contradiction against this finding

Havermans et al. (2015, p.S180) states that "achieving contextual ambidexterity is a major challenge". The pressures to promote exploitative innovation drive out exploratory innovation (Benner & Tushman, 2015). This can be attributed to the distinct aspects of each, such as the goals that each aims to achieve (Lavie et al., 2010; Wu & Wu, 2016); the types of activities promoted (March, 1991); and the different directions of knowledge flows and communication (Raisch & Birkinshaw, 2008).

Overall, contradictions exist between exploitation and exploration, which result in internal tension and conflicting demands (Raisch & Birkinshaw, 2008). The ability of exploitation to positively influence exploration, and visa-versa, as found by this analysis, seems counter intuitive.

6.5.2. Relationship between environmental dynamism and contextual ambidexterity

Even though the multiple regression analysis indicated that environmental dynamism has a significant linear relationship with contextual ambidexterity, little inference could be made. Hair et al. (2010) explains that the relationship between the independent and dependent variables should always be based on theory. A range of sources relates ambidexterity to the organisational environment (Asif, 2017), or details the contextual approaches required to action ambidexterity (Wu & Wu, 2016), or even acknowledge that environmental dynamism is an influencer of the effectiveness of ambidexterity to improve performance (Tamayo-Torres et al., 2017). The direct relationship between environmental dynamism and contextual ambidexterity has however not been propositioned or established.

Sidhu et al. (2004, p.925) confirm that “higher environmental dynamism is linked to a stronger exploration orientation and lower dynamism to a weaker exploration orientation”. It should, however, be noted that the definition used for the exploration-orientation construct in Sidhu et al. (2004), is different from the exploration innovation definition used in this research. This research defines exploration as an innovation activity as defined by March (1991), whereas Sidhu et al. (2004) focused on the supply, demand and geographic information-acquisition process of exploration. Thus, in a highly dynamic environment, organisations will need be more inclined to focus on information gathering to allow for exploration.

This relationship does not have a theoretical base, but proves to be an interesting finding regardless. It is recommended that this specific relationship is researched and analysed further in future research.

6.6. Chapter conclusion

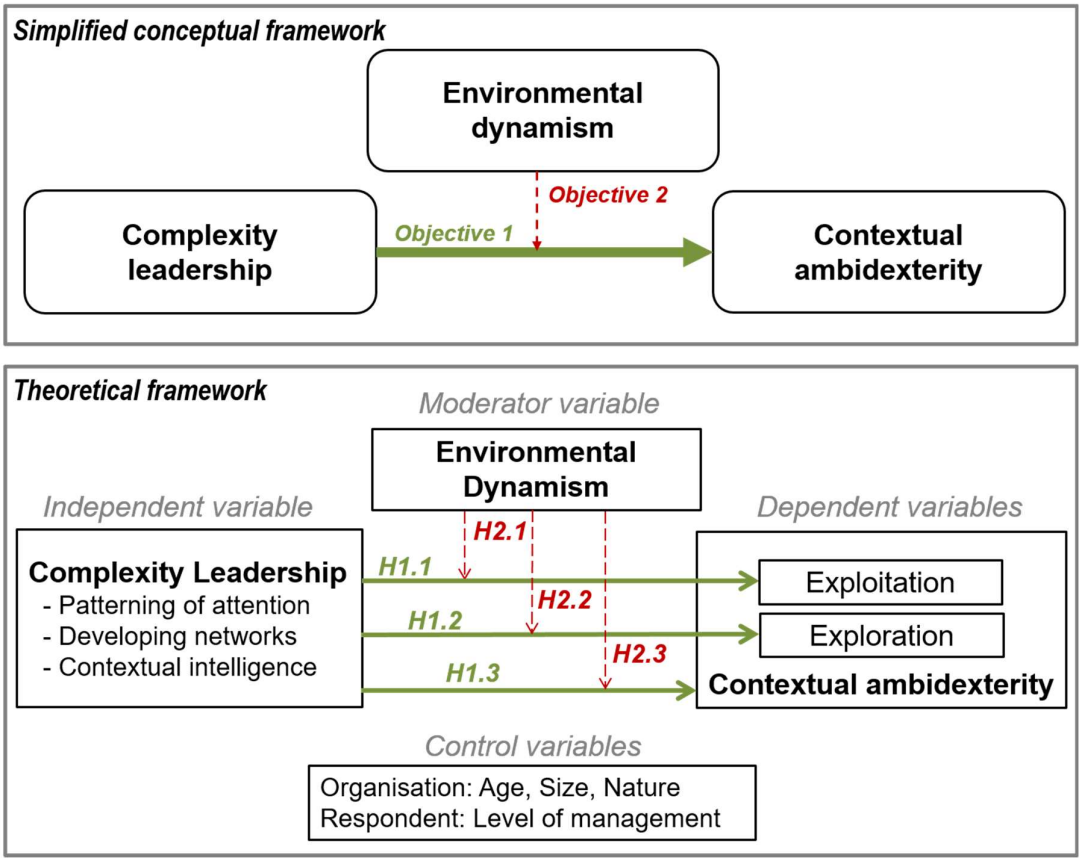
This chapter discussed the relevance of the results obtained, with specific reference to the literature reviewed, as well as the research objectives. Through research objective one, it was confirmed that there exists a significant, positive linear relationship between

complexity leadership and exploitation, between complexity leadership and exploration, and complexity leadership and the combined construct, contextual ambidexterity.

With objective one's relationships established, objective two could be investigated. It was found, however, that environmental dynamims does not have a significant moderating effect on the relationship between complexity leadership and exploitation, exploration, and the combined construct, contextual ambidexterity.

The research findings are summarised on the conceptual and theoretical framework in Figure 28 below. The analyses performed for research objective one found significant positive linear relationships, represented in green. The analyses for research objective two however, found no significant moderating effect on these relationships, represented in red.

Figure 28 – Findings summarised on conceptual and theoretical framework



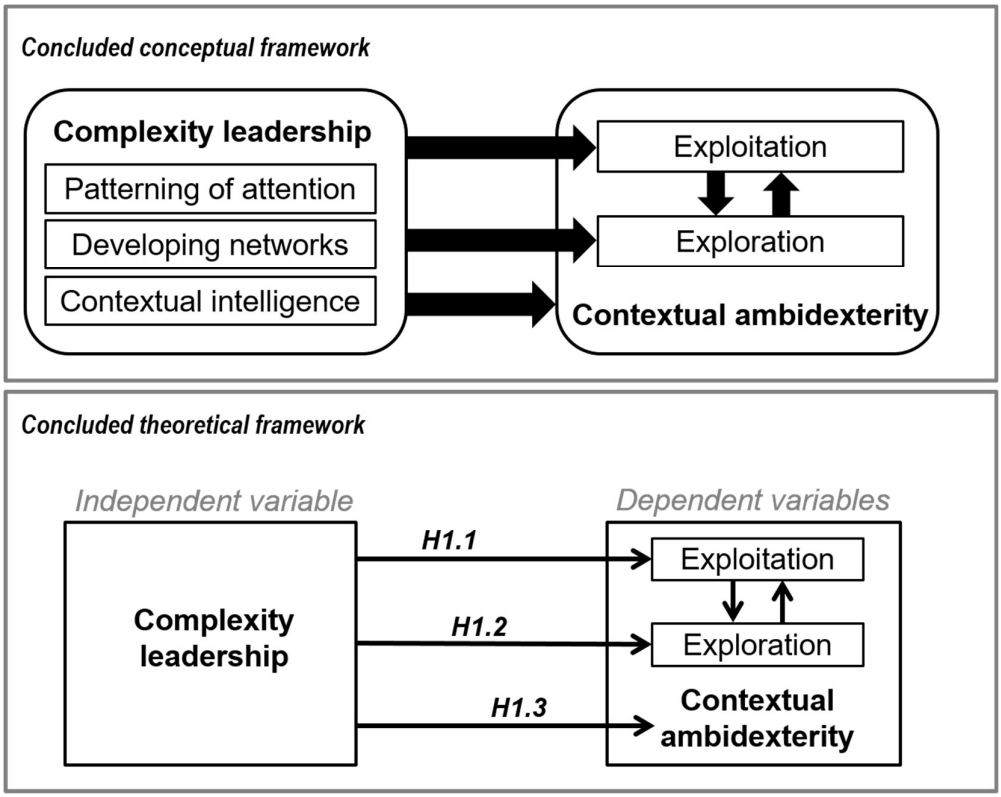
7. Conclusion

This chapter summarises the findings of this research. It concludes the implication of these findings for business, acknowledges the limitations of this research, and recommends future research.

7.1. Summary of findings

The main finding of this research was that: Complexity leadership behaviours, encompassing patterning of attention, building networks, and contextual intelligence, together have a positive influence on exploitation and exploration innovation, as well as the combined concept of contextual ambidexterity. Additional findings include, but are not limited to: environmental dynamism does not moderate the relationship between complexity leadership and exploitation, exploration or contextual ambidexterity; complexity leadership can be measured through the known scales of certain behaviours: patterning of attention, building networks, and contextual intelligence; and exploitation and exploration have significant positive linear relationships. These findings are conceptualised in a final, concluded theoretical and conceptual framework in Figure 29 below.

Figure 29 – Concluded theoretical and conceptual framework



7.2. Implications for business

The increasing rate of complexity in organisational contexts require adaptability and new ways of leading (Uhl-Bien & Arena, 2017). The leadership styles adopted must adapt to ensure organisational success. This research confirmed four important facts, detailed below.

Contextual ambidexterity is important

Firstly, driving contextual ambidexterity, an integration of exploitation and exploration (Nemanich & Vera, 2009), is considered a requirement for an organisation to remain competitive (De Clercq et al., 2014). Organisations should aim to exploit their current operations in innovative ways, whilst exploring with new, innovative ideas. Both are required as a focus on either one of these skill sets individually could result in long-term failure (Tushman & O'Reilly, 1996).

Scholars argue that ambidexterity is a key driver of long-term organisational performance and increasingly empirically examine how it leads to higher performance in respect of aspects such as improved financial performance of new products and increased sales growth (Raisch & Birkinshaw, 2008). As an example, Gibson and Birkinshaw (2004) established that ambidexterity is positively related to business unit performance, measured as achieving its team and individual potential, and having satisfied internal and external stakeholders. Thus, leadership should strive to drive exploitation and exploration innovation *simultaneously* to ensure long-term organisational competitiveness.

Contextual ambidexterity requires leadership

Secondly, organisations only exhibit ambidexterity when leaders *purposefully* aim to simultaneously exploit and explore (De Clercq et al., 2014; Gibson & Birkinshaw, 2004). It is leadership's responsibility to consciously drive ambidexterity to ensure organisational competitiveness. This expectation of leaders, to promote both exploitation and exploration leads to distress, as it creates a 'strategic role conflict' (Floyd & Lane, 2000), an increasingly overwhelming and chaotic feeling (Uhl-Bien & Arena, 2017).

The emerging systemic leadership theories, of which complexity leadership is one, aim to address this. Concepts such as complex adaptive systems assist in simplifying the complex (Anderson, 1999), thereby providing leadership with an approach to address these concerns and navigate these complexities.

Complexity leadership behaviours promote contextual ambidexterity

Thirdly, this research has found empirical evidence that, through complexity leadership activities such as patterning of attention, developing networks, and contextual intelligence, leaders can significantly, positively, influence the organisation's contextual ambidexterity. Contextual ambidexterity emerges when leaders create a supportive internal organisation context (Gibson & Birkinshaw, 2004). This complexity leadership approach creates the supportive context (complex adaptive space) that enables the management of the paradoxical innovation requirement related to contextual ambidexterity.

Complexity leadership behavioural activities could assist leadership in creating the adaptive space needed (internal organisation context) to promote contextual ambidexterity. Below are a few practical examples of the complexity leadership behaviours:

- Facilitate extensive knowledge flows among the managers of different functional areas (De Clercq et al., 2014), combining the concepts of patterning of attention and developing networks.
- Recognise the correct information from the turbulent environment to maintain the balance between stability (exploitation) and adaptability (exploration) (Mendes et al., 2016), with contextual intelligence.
- Establish an ambidextrous organisation architecture that permits each business unit, as well as the organisation as a whole, to simultaneously explore and exploit (Benner & Tushman, 2015), incorporating developed networks.
- Enhance the exchange of information between the agents within the system, which increases the possibility to learn and innovate (Mendes et al., 2016), through patterning of attention.
- Establish the appropriate networks of interactions to give rise to the internal conflicts and tensions, allowing for collective problem solving (Clarke, 2013).
- Develop group cohesion (develop networks) to nurture positive, innovative, outcomes from the tensions of agents' daily activities (Uhl-Bien & Arena, 2017).

The behaviours listed above could assist organisations and business schools alike, to guide leadership selection, development and training:

- Leadership selection: Determining a leader's natural ability to establish the appropriate patterning of attention, developing the required networks, and being contextual intelligent, could be incorporated into an organisation's leadership recruitment approach, interview processes and selection criteria.
- Leadership development: Development of these behaviours and activities could

be incorporated into organisational leadership development programmes, as well as business school development approaches.

- Leadership training: Training on these behaviours could be incorporated in formal business school curriculum, with subject content focused on the theoretical principles of a complexity leadership approach (such as Systems Theory, Network Theory, Contextual Intelligence, etc.).

Context remains important

Lastly, although this study found no significant moderating effect of environmental dynamism on the relationship between complexity leadership and contextual ambidexterity, the importance of the context should not be underestimated. The interaction between leadership and the context within which it occurs, is crucial (Porter & McLaughlin, 2006), and could influence its effectiveness (Osborn et al., 2002). Complexity leadership itself is a dynamic perspective. It proposes that leaders are themselves adapting to the complexity of environmental stimuli, whilst they are attempting to enable contextual ambidexterity (Havermans et al., 2015). The complexity of the context in which an organisation aims to exploit and explore should not be underestimated (Avolio et al., 2009). From this, it is evident that leaders that aim to drive ambidexterity, should consider the context.

7.3. Limitations

All research has inherent limitations. It is important to understand the limitations, as they provide a guide to the potential weaknesses or problems identified by the researcher, that could influence to what extent the research could be generalised (Creswell, 2012). The limitations inherent in the selected research design have been listed in Chapter 4. The significant research design limitations identified, as well as additional limitations of this research, are summarised Table 31 below.

Table 31 – Summary of limitations of this research

Aspect	Description of limitation
Research design	• The sample had a limited geographical reach (South African organisations). • The cross-sectional design does not allow for analysis of trends, over time.
Measurement scales	• With no scale for complexity leadership, a scale was created from known behaviour.

	• The known environmental dynamism scale was reduced to only three items.
Construct definition	• Constructs, including complexity leadership, and contextual ambidexterity, was specifically defined. • The relationships tested were limited to the conceptual model, with minimal additional analyses. • The hypothesised moderator effect of environmental dynamism was shown to be insignificant.

7.4. Future research

Given the findings of this research, and its limitations (as listed in Table 31 above), a few recommendations are made for future research. They range from changes in research design decisions and further measurement scale development; to future research on the relationship between complexity leadership and contextual ambidexterity, and the moderating effect of environmental dynamism on this relationship; and finally, a few relationships uncovered during additional analyses.

7.4.1. Research design

It is recommended that future research is performed with a different research design, to address the limitation inherent in this research. Two aspects that can be addressed are the geographical reach of the sample and the cross-sectional design. Firstly, it is recommended that the sample population be expanded beyond the borders of a single country, to ensure a more global perspective. Secondly, it is recommended that future research investigate how the relationship between complexity leadership and contextual ambidexterity changes over time, in a longitudinal study, which would provide insight into possible trends.

7.4.2. Measurement scale development

Complexity leadership scale development

The combination of patterning of attention, development of networks, and contextual intelligence has been proven to constitute a measure for a high-level construct termed complexity leadership in this research. The scale consists of a total of 20 items. It is recommended that this scale be further refined and made concise, to develop a recognised scale for complexity leadership.

Environmental dynamism scale development

It is evident that the environmental dynamisms, five-item, scale developed by Jansen et al. (2006) is not as transferable as expected. Through a Cronbah's alpha analysis (Creswell, 2012) it was established that two of the five items reduced the internal consistency of the responses.

It is recommended that future research revisit the development of this scale from the foundational work of Volberda and van Bruggen (1997). This instrument included 22 reliable items to measure all six dimensions of environmental turbulence, with seven items measuring environmental dynamism (Volberda & van Bruggen, 1997). Alternatively, another scale that can be considered is the three-item scale developed by Sidhu et al. (2004), based on the scale originally created by Miller (1987) in the article named, "The structural and environmental correlates of business strategy", which attained a Cronbach's alpha of 0.77.

7.4.3. Regression and moderator multiple regression

Relationship between complexity leadership and contextual ambidexterity

With the relationship between complexity leadership and contextual ambidexterity confirmed, it is recommended that future research improve the understanding of how to improve leadership's efforts to drive contextual ambidexterity. This could be achieved through investigation of the mechanisms to utilise, as well as the antecedents that influence the effectiveness of those mechanisms, such as following:

- The relationship between certain complexity leadership activities (such as patterning of attention, developing networks, and contextual intelligence) and contextual ambidexterity;
- The relationship between other leadership styles, such as Authentic leadership (Avolio et al., 2009), and contextual ambidexterity;
- The relationship between other antecedents (such as dynamic capabilities, job design and knowledge inflow patterns), and contextual ambidexterity, and their relative importance (Asif, 2017).

In essence, by understanding how leadership influence the causal processes that drive desired organisational outcomes, scholars can develop integrated perspectives (Dinh et al., 2014), with practical value to leadership.

Environmental dynamism as moderator of the relationship between complexity leadership and contextual ambidexterity

Contrary to the deduction made from available literature, the moderator effect of environmental dynamisms on the relationship between complexity leadership and contextual ambidexterity was not found to be significant. In contrast, Jansen et al. (2009) did establish the moderator effect of environmental dynamism between specific leadership styles (transformational and transactional), and exploitation and exploration, by only investigating a single large organisation, in one country context. It is recommended that future literature investigate this moderating effect in different types of contexts: a case study of a single organisation, an industry comparison of a few organisations, and a study unbounded by either (similar to this research).

7.4.4. Additional analyses

Relationship between exploitation and exploration

Although not a part of this research's conceptualised model, it was proven that exploitation and exploration have a significant, positive linear relationship. It is recommended that future literature investigate this finding to confirm this relationship, investigate the antecedents and boundary conditions to this relationship.

Relationship between environmental dynamism and contextual ambidexterity

With little of the appropriate literature reviewed, the significant, positive, linear relationship found between environmental dynamism and contextual ambidexterity could not be substantiated. Future research could investigate this relationship more comprehensively. A review and summary of the available literature would be valuable, specifically with a broader definition of environmental dynamism. From this, a framework can be developed to investigate how environmental dynamism influences contextual ambidexterity.

7.4.5. Additional studies

A range of empirical studies has addressed contextual ambidexterity since Raisch and Birkinshaw (2008) summarised the antecedents and elements of ambidexterity in 2008, including this research. It is recommended that a new summary be made of the research focused on contextual ambidexterity, to conceptualise this research paradigm. Conceptualisation of the antecedents, elements and relationships of contextual ambidexterity would improve the overall understanding contextual ambidexterity, and reveal required future enquiry.

7.5. Document conclusion

Organisations need to implement both incremental innovation (exploitation), and radical innovation (exploration) to ensure success and survival. Exploitation promotes short-term success through efficiency in current operations, whereas exploration ensures future viability through new entrepreneurial ideas. The emerging complexity leadership theory acknowledges the need to promote both exploitation and exploration, simultaneously, a concept defined as contextual ambidexterity.

Therefore, both contextual ambidexterity and complexity leadership aim to ensure an organisation's short- and long-term success, within a changing organisational environment. Regardless of the similarities in goals, available literature has not yet established if complexity leadership influences contextual ambidexterity. This research statistically analysed a sample of 1 204 secondary survey responses to establish this relationship, as well as the possible moderating influence of the dynamism of the environment.

The first objective of this research established that complexity leadership has a positive influential relationship with exploitation, exploration, and the combined construct contextual ambidexterity. This finding indicates that, through complexity leadership behaviours, an organisation can promote contextual ambidexterity, enabling the simultaneous implementation of incremental (exploitation) and radical innovation (exploration). Organisations that wish to drive contextual ambidexterity could incorporate these behaviours (patterning of attention, developing networks, and contextual intelligence) into leadership selection, development and training.

The second objective of this research hypothesised that environmental dynamism, defined as the accelerated rate of change in organisational environments, would moderate the relation between complexity leadership and contextual ambidexterity. The moderator effect was however found not to be significant. This finding does not discredit the importance of the context within which complexity leadership and contextual ambidexterity occur. For this reason, recommendations for future research include, but is not limited to, further investigation of environmental dynamism and other contextual factors.

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Appendix 1: Literature figures

Figure 30 - A framework for understanding organisational ambidexterity research. Source: Raisch, S., & Birkinshaw, J. (2008). Organizational Ambidexterity: Antecedents, Outcomes, and Moderators. Journal of Management, 34(3), 375-409. doi: 10.1177/0149206308316058

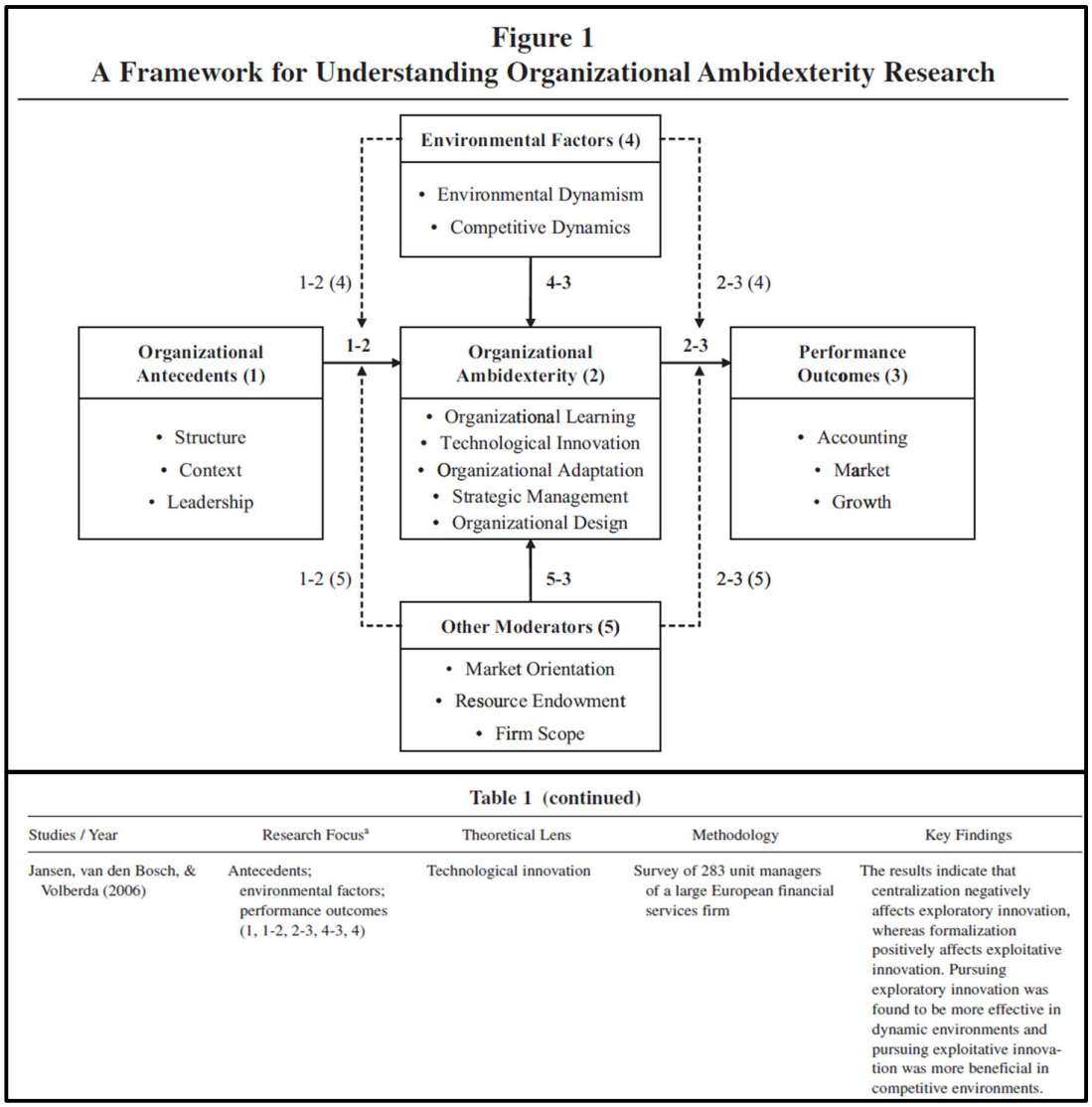


Table 1 (continued)

Studies / Year	Research Focus[a]	Theoretical Lens	Methodology	Key Findings
Jansen, van den Bosch, & Volberda (2006)	Antecedents; environmental factors; performance outcomes (1, 1-2, 2-3, 4-3, 4)	Technological innovation	Survey of 283 unit managers of a large European financial services firm	The results indicate that centralization negatively affects exploratory innovation, whereas formalization positively affects exploitative innovation. Pursuing exploratory innovation was found to be more effective in dynamic environments and pursuing exploitative innovation was more beneficial in competitive environments.

Figure 31 – Theoretical framework of the moderating effect of environmental dynamism on the relationship between transformation and transactional leadership, and exploitative and explorative innovation. Source: Jansen, J.J.P., Vera, D., & Crossan, M. (2009). Strategic leadership for exploration and exploitation: The moderating role of environmental dynamism. The Leadership Quarterly, 20(1), 5-18. doi:10.1016/j.leaqua.2008.11.008

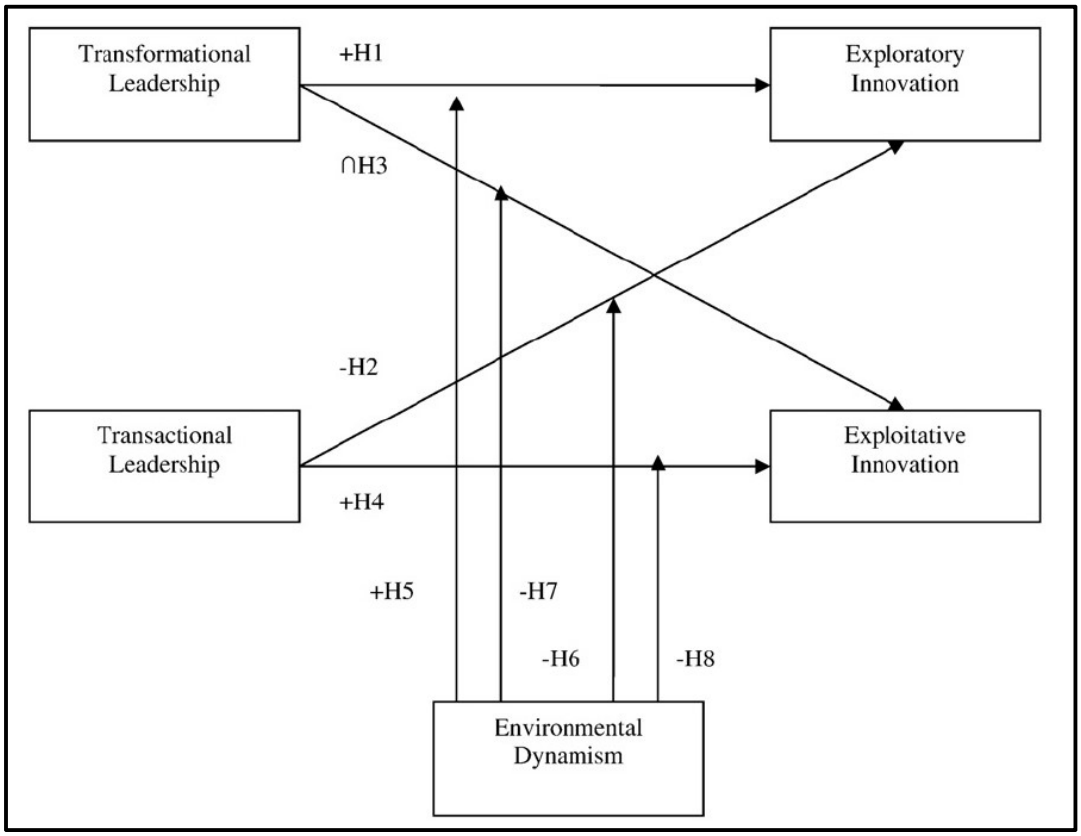


Figure 32 – Adapted version of Jansen et al. (2009) findings regarding the moderating effect of environmental dynamism on the relationship between transformation and transactional leadership, and exploitative and explorative innovation.

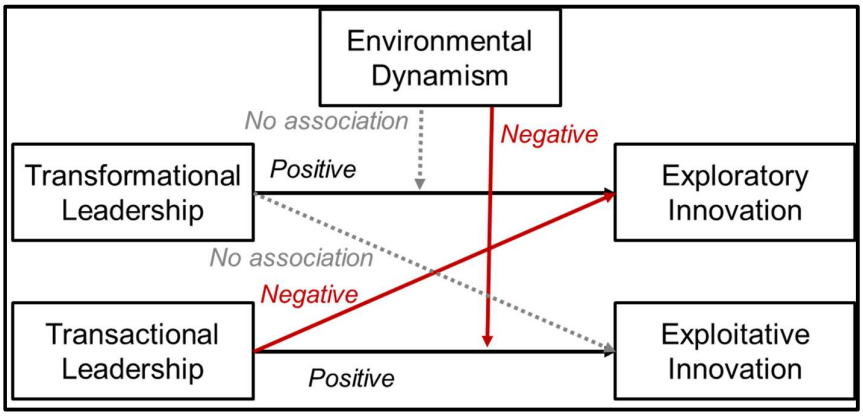
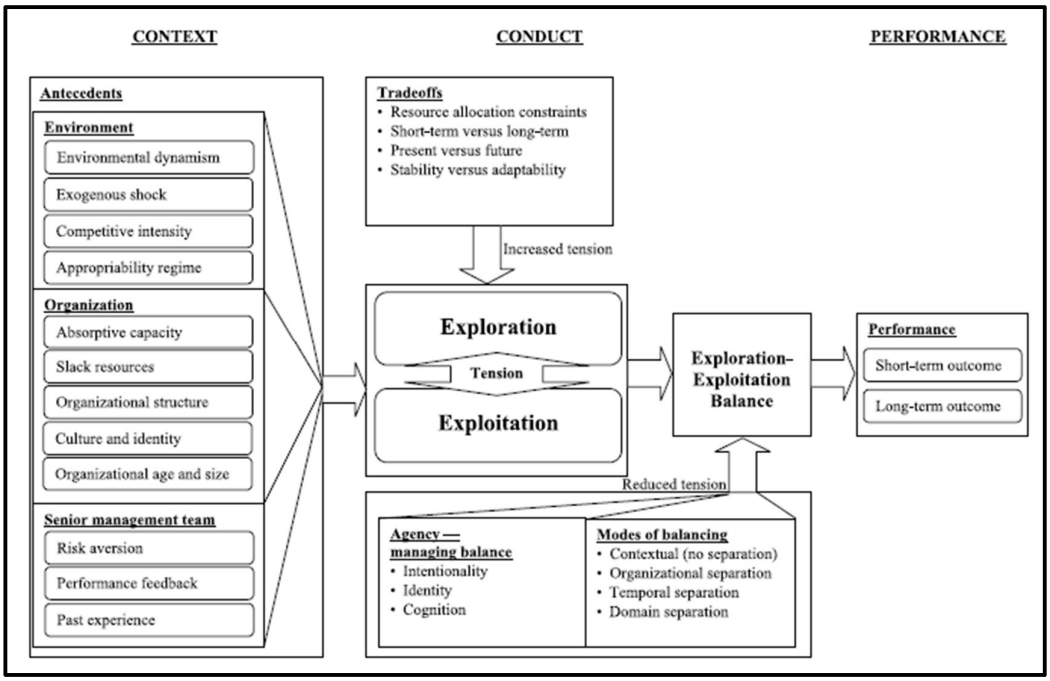


Figure 33 - Framework of Exploration-Exploitation. Source: Lavie, D., Stettner, U., & Tushman, M.L. (2010). Exploration and Exploitation Within and Across Organisations. Academy of Management, 4(1), 109–155. doi: 10.1080/19416521003691287



Appendix 2: Literature tables

Table 32 - Key terms in complexity theory

Key term	Description
Adaptive response	An adaptive response occurs as networked agents are able to resonate around a new approach, or adaptive solution, that meets a need of a complex challenge (Uhl-Bien & Arena, 2017).
Edge of chaos	Pascale (1999, p.92) states that "generative complexity takes place in the boundary between rigidity and randomness", known as the edge of chaos.
Self-organisation	Self-organisation arises from intelligence in the remote clusters within a network (Pascale, 1999).
"Space between"	Innovations are generated during an adaptive response. These innovations, or emergence of novelty, occur during connected interactions between agents, and no single person can claim it for themselves (Uhl-Bien & Arena, 2017).
Complexity dynamics	Leaders that successfully enable adaptive systems recognise the dynamics of conflicting tensions, and the linking up of networks (Uhl-Bien & Arena, 2017).
Emergence	Emergence is the creation of new order that happens when 'agents' in a networked system, within a context poised for change, combine together to generate the emergence of something new, that did not exist previously (Uhl-Bien & Arena, 2017). This process occurs when interacting agents of a system begin to link up in response to some kind of need, and are dynamic in nature (Uhl-Bien & Arena, 2017).

Table 33 - Types of organisational environments. Adapted from Cummings and Worley (2015, p.96–97)

Organisational environment	Description
General environment	Consists of all the external forces affecting organisational results. This includes external social, technological, logical, ecological, economic, and political or regulatory forces.
Task environment	Describes the industry level forces affecting organisational results. This includes major stakeholders such as customers, suppliers, shareholders, creditors and regulatory agencies (Jain, 2005).
Enacted environment	How the members of the organisation perceive the general and task environments, affecting the chosen organisational responses.

Appendix 3: Questionnaire design

Table 34 – Questionnaire questions

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)
Contextual ambidexterity (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 organisation 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 organisation 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 organisation expands services for existing clients (Q12_13)
7. Lowering costs of internal processes is an important objective (Q12_14)

Moderator Variable

Environmental dynamism

(*Volberda and van Bruggen (1997); as adapted by Jansen, van den Bosch and Volberda (2006)*)

1. Environmental changes in our local market are intense (Q12_15)
2. Our clients regularly ask for new products and services (Q12_16)
3. In our local market, changes are taking place continuously (Q12_17)
4. In a year, nothing has changed in our market (Q12_18)
5. In our market, the volumes of products and services to be delivered change fast and often (Q12_19)

Independent Variable (Predictors or called Antecedents)

Complexity Leadership

a) **Patterning of attention**

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**

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**

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)

Table 35 - Contextual intelligence scale elements, adapted from Kutz (2008)

12 Behaviours and skills associated with contextual intelligence, adapted from Kutz (2008)			
#	**Skill**	**Description**	**Included in scale**
1	Future-minded	Forward-minded, with a sense of direction. Resulting in particular concern for where the organisation should be in the future.	Yes
2	Influencer	Interpersonal skills used to, through ethical and non-coercive means, affect the actions and decisions of others.	Yes
3	Ensure an awareness of the mission	Understand and communicate how the individual performance of others (including subordinate's, peer's, and supervisor's) influence the perceptions of how the mission would be accomplished.	Yes
4	Socially responsible	Express concern about social trends and issues. Encourages legislation and policy, and personally volunteers in social and community activities.	No
5	Culturally sensitivity	Promotes diversity in multiple contexts. Creates and facilitates alignment of individuals through opportunities interaction, in a non-discriminatory context.	Yes
6	Multicultural leadership	Able to influence and affect the behaviours of others in an ethnically diverse context.	Yes
7	Context diagnoses	Appropriately interprets and reacts to a changing, and even volatile context.	Yes
8	Change agent	Courageous, and proactively raises difficult and challenging questions. Rises to challenges, and is participative in, and leads, change.	No
9	Effective and constructive use of personal influence	Use interpersonal skills, personal power, as well as influence, to effectively and constructively, affect the behaviour and decisions of others. Effectively uses all different type of power.	No
10	Intentional leadership	Assesse and evaluate own leadership performance. Is aware of personal strengths and weaknesses and continuously improves leadership abilities.	No
11	Critical thinker	Cognitive ability to make integrate knowledge, and make practical applications.	Yes
12	Consensus builder	Exhibit interpersonal skill, and can convince other people to see the common good. Use listening skills, manages conflict situations, and creates win-win scenarios.	No

Appendix 4: Data analysis tables

Exploratory factor analysis

Table 36 – Varimax rotation

	Varimax rotation: Components			
	Complexity Leadership	Exploration	Exploitation	Environmental Dynamism
Explo1		.769		
Explo2		.727		
Explo3		.786		
Explo4		.793		
Explo5		.689	.365	
Explo6		.665	.320	
Explo7		.588	.410	
Exploi1		.418	.653	
Exploi2		.370	.640	
Exploi3		.449	.651	
Exploi4		.301	.752	
Exploi5			.703	
Exploi6		.440	.560	
Exploi7			.631	
PA1	.745			
PA2	.750			
PA3	.767			
PA4	.777			
PA5	.726			
PA6	.749			
DN1	.738			
DN2	.730			
DN3	.723			
DN4	.773			
DN5	.788			
DN6	.734			
CI1	.780			
CI2	.785			
CI3	.738			
CI4	.683			
CI5	.763			
CI6	.746			
CI7	.756			

ED1				.640
ED2		.473		.521
ED3				.770
ED4				.582
ED5		.334		.530

Introductory analysis

Table 37 – Descriptive statistics: Complexity leadership

	Descriptive statistics: Complexity leadership			
	PA	DN	CI	CL
Mean	3,52	3,47	3,61	3,54
Standard Error	0,03	0,03	0,03	0,03
Median	3,67	3,67	3,71	3,68
Mode	4,00	4,00	4,00	4,00
Standard Deviation	0,99	0,96	0,93	0,90
Sample Variance	0,97	0,92	0,86	0,81
Count	1 204	1 204	1 204	1 204
Confidence Level(95,0%)	0,06	0,05	0,05	0,05

Table 38 – Descriptive statistics: Contextual ambidexterity

	Descriptive statistics: Contextual ambidexterity		
	Exploi	Explo	CA
Mean	3,91	3,70	3,81
Standard Error	0,02	0,03	0,02
Median	4,00	3,86	3,93
Mode	5,00	4,00	4,50
Standard Deviation	0,79	0,93	0,80
Sample Variance	0,62	0,86	0,63
Count	1 204	1 204	1 204
Confidence Level(95,0%)	0,04	0,05	0,05

Table 39 – Descriptive statistics: Environmental dynamism

	Descriptive statistics: Environmental dynamism			
	ED2	ED3	ED5	ED
Mean	3,61	4,02	3,57	3,74
Standard Error	0,03	0,03	0,03	0,02
Median	4,00	4,00	4,00	3,67
Mode	4,00	4,00	4,00	3,67
Standard Deviation	1,02	0,98	1,12	0,83
Sample Variance	1,05	0,96	1,26	0,70
Count	1 204	1 204	1 204	1 204
Confidence Level(95,0%)	0,06	0,06	0,06	0,05