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Digital Leadership:

Transitioning into the digital age

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Originality Statement

To the best of belief and knowledge, work presented in this thesis is originally mine, except where acknowledged herein. No attempt is been made to present contributions from other researchers as my own, and all sources used in this research are given appropriate citation. Material in this research has not been submitted, in part or whole for another degree at this university or any other university.

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Kylie Ann Prince

Dedication

This thesis is dedicated to my children

Gavin and Renae

and

in memory of my late parents

Herb and Yvette Prince

Acknowledgements

Statement of the Contribution of Others

Research contained herein this thesis is a result of team-based collaboration between Kylie Prince, Professor John Hamilton and Dr SingWhat Tee. Professor Hamilton and Dr Tee spent a great deal of time teaching me to transform my writing from that of a Psychologist to that of a business executive. Transition is apt considering the nature of this research content around transformation.

Professor Hamilton and Dr Tee guided every step of research process, meeting with me weekly. From brain-storming and planning research, to data capture techniques and analysis, to thesis write-up, they are there every step of the way. While Dr Tee has an operational focus in teaching me how to be an excellent researcher, Professor Hamilton showed me how to be conceptually strategic with research. This pattern persisted through the entire research process.

Professor Hamilton has a vision this research would be revolutionary in how it would transition Australian corporates through digital transformation, with Digital Leadership; and how it would improve Australia's global digital position. He could see potential in Digital Leadership and understood how Digital Leadership is multi-dimensional and how each leadership approach could influence digital transformation in a different way. His vision has a positive influence on how to measure and test such a model and real-world applicability this model may have for Australian corporate CEOs.

Dr Tee provided support for this research immersing himself into the research process, teaching me how to find good suitable literature and how to understand it from a business perspective. Dr Tee contributed to all stages of research process including planning, providing excellent feedback on how to improve each research step. Dr Tee's knowledge and understanding of statistical analysis, together with Professor Hamilton who taught me structural equation modelling is truly amazing, and he is patient with my learning.

Three research publications ae developed and submitted to academic conferences during research time of this thesis development. These publications are listed in Appendix D. Professor John Hamilton presented two of these research papers at two conferences.

Ethics associated with this research and thesis complies with current laws of Australian and all permits necessary for the project were obtained (JCU Human Ethics H6962).

Original research data is retained in the College of Business, Law & Governance. This is in accordance with JCU research data: storage and management guidelines.

Kylie Ann Prince

Abstract

Aims and Objectives

Today's globally competitive digital business environments drive CEOs quest for Australian corporates to find global sustainability. Such Australian corporate CEOs see business success as more than simply competition defined by financial profit. These CEOs likely recognise digital business models should encompass strong customer focus, and a need to improve performance for betterment of society.

In doing so, today's Australian corporate CEOs generally recognize both they and their corporate need to be digitally savvy and engaged in jointly managing digitally-enabled business models. Consequently, many Australian corporates are undergoing some form of digital transformation yet estimates of only 8% of Australian corporates are getting their desired results.

Therefore, a Digital Leadership framework supports Australian corporate CEOs development in the digital age is important, and to develop a transitioning model to help Australian corporate CEOs understand how to digitally transform in an easy simplified manner is also important.

Scope

Even though tomorrow's digital frontier remains partly unknown, new digital business models are emerging, shaping and disrupting existing global business environment. Australian corporate CEOs are now competing for a finite global marketspace in a competitive digital environment. Thus, these CEOs are exploring smart strategies to digitally advance their corporate. This is known as digital transformation.

Previous research indicates only 5% of corporate CEOs possess strong Digital Leadership credentials, but 72% are wanting to develop new Digital Leadership programs. While projections into the future indicate by 2025 adoption and use of digital technologies may add around $250B to Australia's GDP, further projections to 2050 indicate China expects greater GDP than United States and India expects to be 3rd globally in GDP.

Therefore, Australian CEOs need to be prepared to lead their corporates through radical digital transformation using strong Digital Leadership. However, outlook indicates 86% of Australian business leaders are 'overwhelmed' by digital transformation projects, and 70% are struggling to keep pace with digital innovation.

Globally, today's corporate leaders display a competitive global focus, flexibility with using one or more leadership approaches creating dynamic, digital engagement strategies energize and motivate their workforce to promote collaboration. Countries such as China acknowledge technologies shape demand for digital skills, and indicate skills in business analytics, mobile connectivities and cloud data shall be needed across the next five years, at least.

Global CEOs must also pursue similar digital transformations to remain competitive. Although Australian corporate CEOs acknowledge need to digitally transform, they may need a cutting-edge leadership approach to lead digital transformation in order to outperform global competition. This required cutting-edge leadership approach is known in this research as Digital Leadership.

Literature support best leadership approach in the digital age is a combination of leadership approaches with broad leadership strategies and skills sets. Hence, this research proposes a Digital Leadership framework encompassing a combination of three macro leadership approaches (authentic, transactional, and transformational).

A Digital Leadership framework is developed to define Digital Leadership; and further develops a Digital Leadership Conceptual Model to explain Digital Leaders influence on digital transformation processes. This research then proposes this conceptual model as the Digital Leadership Research Model, ready for testing.

Methodology

This research uses mixed methods to test the Digital Leadership Research Model. Measurement items are developed from existing measures and compiled into a survey structure. This on-line survey is conducted with Australian corporate CEOs, with N=165 usable responses.

Quantitative data supports testing of the Digital Leadership Research Model. While qualitative data provides further support and interesting analysis of Australian CEOs opinions on most important factors a corporate leader should have in the digital age.

Data analysis plans to use appropriate software for; data preparation, frequencies and factor reduction (SPSS), structural equation modelling (SEM) path analysis (AMOS), and qualitative analysis (NVivo).

Results Summary

Data validates through comparing demographic information with previously published data. Descriptive statistics analysed, and data found to have normal distribution. Overall SEM measures of goodness-of-fit of the Digital Leadership Research Model are excellent.

Qualitative results provide support for the SEM path model and demonstrate how Digital Leadership may be measured in a three-dimensional space. Further analysis provides insight into how Australian corporate leaders are thinking with interesting word frequency effects.

Conclusions

Although qualitative responses from Australian corporate CEOs suggest strong digital transformation understanding, they demonstrate transformation is not top-of-mind. There appears to be a mismatch between Australian corporate CEOs level of digital savviness and ability to implement digital transformation.

This research makes real-world contributions to how Digital Leaders may achieve digital transformation, through various pathways; and supports conceptualisation of Digital Leadership. This is discussed comparatively with digitally transforming corporates. Further contributions include defining Digital Leadership, and foundations for development of a Digital Leadership theory. Future contribution includes developing the Digital Leadership Research Model as a theoretical transformation model.

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1.0 Chapter One – Introduction

To remain competitive in today's digital age Australian corporate CEOs likely add digital interdisciplinary skills, strong business functions/industries/technologies capabilities, close workforce engagement capabilities, continual learning and improvement, an innovative drive, and risk-taking to their Digital Leadership model (Panetta, 2018). Yet Deloitte's (2017) Human Capital Trends survey shows only 5% of corporates are seen to have strong Digital Leaders. However, 72% of Deloitte's survey respondents did indicate a preference to develop new Digital Leadership programs.

Digital Leadership is also customer focused, and this engages both technology and human interface insights (Panetta, 2018). Thus, leaders must inspire and rewire workforce culture and talents into new ways of thinking/collaborating/connecting. Here, Digital Leaders are typically thinking, acting and reacting differently when compared to traditional leaders. (Abbatiello, Philpot & Roy, 2018).

1.1 Background Australian Corporates Today

In late 2015 Australian corporate CEOs operated through a top-down leadership approach, with only 27% feeling confident regarding their corporate's readiness to respond to new digital trends (Deloitte Digital Anon, 2015). In these corporates, only 8% saw digital customer/citizen involvement as high.

In today's globally competitive digital business environments (Ferris, 2017), CEOs of Australian corporates are in quests for global sustainability (Nally, 2016). One possibility towards sustainability is through adoption of new variants to existing leadership approaches (Abbatiello, Philpot & Roy, 2018). These Australian corporate CEOs likely recognize digital change occurring to (and around) their corporate (Sayers, 2016).

Such corporate CEOs see business success as digital, competitive, and defined by more than financial profit (Sayers, 2016). These corporate CEOs are typically agile, digitally aligned, strongly motivated, promote meaningful values, and display inspirational leadership (Rennie et al., 2016). They likely recognize their individual corporate business model needs realignment against today's emergent: digital connectivities systems, new AI/BI knowledge options, and advanced robotic digital manufacturing (and services) systems (Cearley et al., 2107). Such change requirements likely generate a digital transformation of corporate, and this likely involves new digital skills sets and new digital strategies (Christian et al., 2015; Sow & Aborbie, 2018).

Today's Australian corporate CEOs generally recognize both they, and their workforce, need to be digitally savvy (84%) and engaged in jointly managing their digitally-enabled corporate business model (Deloitte Insights Anon, 2018). However, except for a few leading Australian corporates (like Rio Tinto, BHP, Woodside, Origin Energy, Toll, Qantas, VISY, Bosch, Coles, Woolworths & emerging Super-Farm operations), this corporate digital savviness approach is only being considered by 23% of Australian corporate CEOs (Deloitte Insights Anon, 2018).

In its 2017 report McKinsey (Digital/McKinsey Anon, 2017) noted for Australia to realize opportunities offered by the digital age, and corporate CEOs need to reshape and competitively-lead in global digital economy. They also predict digital innovation could boost Australia's economy by $250B over next eight years. Hence, the CEOs of Australian corporates need to develop suites of globally-competitive, digital-age strategies and skills (Australian Government Anon, 2017). Hence, this study investigates whether CEOs of Australian corporates first need to apply a Digital Leadership approach utilizes possible digital imperatives (enablers, capabilities, and tools) reside within current and emerging Industrie 4.0 environment.

1.2 Motivation

Gartner (2018) advises around two-thirds of Australian corporates are undergoing some form of transformation, but only 8% of Australian corporates are getting results from their digital transformation activities, with many failing to recognize risks of not scaling and not following technologies adoption (Beresford, 2018). Hence this study examines if Australian Corporate CEOs do require a Digital Leadership approach influences a framework for corporate digital transformation.

1.3 Digital Leadership

Beresford (2018) argues there are currently four business-enabling models applicable to the digital age; (1) human collaboration (where CEOs workforce become a united, authentic team), (2) orchestration (where CEOs shared transactional leadership approach has a greater impact on team performance and productivity), (3) creation (where CEOs innovation inclusions deliver a transformational approach) and (4) matching (where a copy-others approach is deployed).

Researchers considering leadership today through models such as Multifactor Leadership Questionnaire (MLQ) (Bass & Avolio, 1995), model groupings with network relationships between groupings (Zhu et al., In Press), and network groupings related to

transformational leadership (Meuser et al., 2016). This suggests leadership approaches today, are related and may be grouped into generalized approaches. Hence, this study examines whether Digital Leadership encompasses one approach, or whether it remains a combination of multiple approaches (Gunzel-Jensen et al., 2018).

Zhu et al. (In Press) groups many leadership approaches by linking their overarching theories. For example, authentic leadership is linked with ethical and moral leadership via social exchange theory. Hence leadership theories can be grouped (refer Chapter 2). Further, Avolio and Gardner (2005) find overlap conceptually between authentic and transformational leadership approaches. Hoch et al. (2018) find correlation between authentic, transactional and transformational leadership approaches.

Investigating leadership approaches today, this study aims to develop a Digital Leadership framework. George (2018) suggest a Digital Leader can at times hand over corporate reins to others when specific circumstances are encountered. Further, instead of a power-based position, Digital Leaders are likely self-organized leaders, adopting people first principles, engaging trust and collaboration, and deploying innovative situational leadership (George, 2018).

Gunzel-Jensen et al. (2018) suggest Digital Leadership relates transactional, transformational and empowering (authentic) leadership, along with innovative behavior. Thus, Digital Leaders display a wide range of capabilities, and may adopt one or more leadership approaches. Very broad leadership approaches (authentic, transactional and transformational) can typically incorporate many more specific approaches. Hence, this study assesses whether Digital Leadership captures a combination of these broad approaches.

For strategic success of digital transformation of corporate and business ecosystems, Digital Leaders always do the right thing (Sawy et al., 2016). This likely involves; new digital strategies, new models, new systems integrations, new people mindsets and new digital skills sets, new technologies, and changed workplaces (Sawy et al., 2016). Toomey (2016), suggests Digital Leadership is capability of corporate leaders (and CEOs) to identify and realize (digital age) opportunities for business growth, and value, through effective, efficient, and acceptable use of (digital) business technologies (de Waal, Outvorst & Ravesteyn, 2016).

Zupancic et al. (2016) suggest Digital Leadership is capability to integrally view both corporate architecture, and design of digital tools, can then strategically enable new designs; and this requires digital skills. Sia, Sou and Weill (2016) suggest, when championed by the CEO, strong Digital Leadership can enact a systematic digital

transformation which can pervade entire corporate. This suggests, Digital Leadership relates to digital tools and then to digital strategies and digital skills.

In today's digital age, a corporate CEOs engagement of digital tools is selective, connective, autonomous, empowered, analytics, and technologies driven (Newman, 2017; Pettey, 2018). This sets corporate digital imperative. It provides an enabling pathway for a corporate CEO to deliver business transformations (Siebel, 2017). This approach also generates a changed strategy and skills set across corporate (Welz, 2018).

1.4 Research Question

Hence, this study seeks to understand '*how Australian corporate CEOs drive digital innovation within their corporate'.* Embedded within this research, and from an Australian corporate CEOs leadership perspective, this study also examines *whether Digital Leadership is a combination of key leadership approaches.*

These lead the study to then ask, *'do Australian corporate CEOs influence corporate digital transformation through their application of corporate digital imperatives?*'

1.5 Theoretical Considerations

Leadership literature shall be added to by clarification and explanation around Digital Leadership. It presents a Digital Leadership transformation model, and a three-dimensional relational space model. These vehicles can be used by Australian corporate CEOs when developing their corporate digital age digital transformations.

1.5.1 Practical Contributions

No one leadership approach yet predominates in the digital age, and no one leadership approach yet fits all Digital Leadership requirements. This study suggests Digital Leadership as a likely combination of leadership approaches, which may also vary from place to place, and situation to situation.

This study can add value to current Australian government design policy and procedures for public entities, and private corporates, operating in the digital age.

This study helps identify digital skills and digital strategies that enable and implement digital transformation of a corporate, or a government entity/sector, operating in the digital age.

1.6 Organization of Thesis

Chapter one introduces the need for a different mode of leadership for a better fit to digital age requirements of modern corporate leadership.

Chapter two frames literature under three leadership approaches and suggests a Digital Leadership approach may be more appropriate for the digital age. It shows Digital Leadership approaches are linked to digital imperatives (enablers, capabilities, and tools) and to delivering digital transformation across their corporate. This chapter concludes by proposing a testable *'Digital Leadership Research Model.'*

Chapter three introduces qualitative and quantitative methodologies deployed for data capture, and for construct development and validation.

Chapter four introduces the quantitative approach deployed to test the *'Digital Leadership Research Model.'* It first engages factor reduction, develops constructs, executes SEM analysis, and bootstrap validates resultant excellent fit model. The qualitative section of chapter four engages NVivo, covering word cloud and word tree associations, directional project map validation of the *Digital Leadership Research Model.* Cluster analysis then places leadership qualitative constructs, digital imperatives qualitative constructs and digital transformation qualitative constructs into relative 3D spaces.

Chapter 5 provides model and significant paths discussion, following with implications section. This chapter explains the *Digital Leadership Research Model* and interprets total effects pathways influences across the model and delivers thesis conclusions. Also, this chapter presents theoretical, and real-world contributions this research makes, together with limitations, and future directions.

1.7 Chapter One Summary

Today digital age Australian corporate CEOs are in quests for global sustainability. Such corporate CEOs see business success as digital, globally competitive, and defined by more than financial profit. They likely recognize their individual corporate business model needs realignment using digital toolkits, and such changes likely generate digital transformation of corporate. This study investigates how Digital Leadership influences digital transformation through application of digital imperatives from an Australian corporate CEOs leadership perspective, and as a combination of key leadership approaches.

2.0 Chapter Two – Review of Literature & Model Development

2.1 Literature Review

Tomorrow's digital frontier remains partly unknown. New digital business models are emerging, and some are disrupting existing global business environment. Increasingly, Australia's corporate CEOs are now competing for a finite global marketspace, and doing so against emerging agile, innovative, low-overhead, digital marketspace sellers. These new digital age competitors often bring innovative new digital platform solutions, new value chain solutions, and new digital services approaches into global business domains. Those corporates with digital agility – like Rio Tinto are digitally ready and capable of out-competing such challenges (Rio Tinto, 2018).

However, although 84% of Australia's corporate CEOs are aware of their corporate's need for digital savviness, only 23% are actively pursuing this imperative (Deloitte Anon, 2018). Deloitte's (2017) global survey shows around 5% of corporate CEOs possess strong Digital Leadership credentials, but 72% of respondents exhibit a preference to develop new Digital Leadership programs. Thus, corporate CEOs are seeking smart strategic and digital skills pathways, so they can competitively and successfully advance their corporate within tomorrow's digital frontier.

In 2017, 94% of Australia's citizens connected to internet, and by 2025 adoption and use of digital technologies can add around $250B to Australia's GDP (Deloitte, 2017). This Australian corporate financial digital imperative is a CEO driver for innovating and developing a strong digital and competitive presence.

Projecting into the future, Australia faces stiff competition from emerging Asian markets (Ferris, 2017). By 2050, China expects 50 per cent greater GDP than United States and India expects to climb to 3rd globally in GDP. These factors make it particularly important for Australia to be more competitive in global markets, especially with such close geographic regions. Such global competition may motivate Australia to accelerate and stimulate growth as digital technologies combine with industry to improve productivity (Ferris, 2017).

However according to KPMG Global CEO Outlook, Australian perspective (Wingrove, 2018) indicates optimism with 68 per cent of Australian corporate CEOs saying they are prepared to lead their organization through radical transformation. However, the outlook also indicates 86% of Australian business leaders are 'overwhelmed' by digital transformation projects currently underway, and seventy per cent are struggling to keep pace with rate of digital innovation (Wingrove, 2018).

2.1.1 Leadership Today

Today's global corporate leaders display a competitive global focus, flexibility, and one or more leadership approaches (Gunzel-Jensen et al., 2018; Marques, 2015). They create dynamic, digital engagement strategies (Shaughnessy, 2018); that energize and motivate their workforce (Webb, 2016); to promote collaboration (Kinsey Goman, 2017).

In China, 80% of its corporate leaders suggest technologies shape their demand for skills. Eighty-five per cent externally collaborate when building their new digital capabilities, and 81% look beyond their corporate for emergent digital skills (Marshall et al., 2018). They indicate digital technologies like cloud data, business analytics, and mobile connectivities, are requirements across the next 5 years, at least. Thus, CEOs of competitive global corporates must also pursue similar digital transformations (Seibel, 2017).

Corporate leaders also want to know: "What technologies are coming and how they might reshape my industry?" (Berman & Dalzell-Payne, 2018, pp. 12). Some reconceive their corporate futures against digital reinvention, and so measure today's digital investments against tomorrow's perceived new digital context (Berman & Dalzell-Payne, 2018). This type of digital transformation encompasses digital strategies and digital skills (Bolden & O'Regan, 2016; Nally, 2016; Whitehurst, 2015), and these are delivered through digital imperatives (Dasi et al., 2017).

Today, Australian corporate CEOs display a wide range of leadership approaches (Kouzes, Posner & Bunting, 2015), which can be grouped against theoretical approaches (Dinh et al., 2014; Zhu et al., In Press). Key theory-based leadership approaches are outlined in table 2.1 (and Appendix B). This table shows leadership approaches of corporate CEOs can be theory cross-grouped into three main macro leadership approaches – authentic, transactional, and/or transformational.

Dinh et al. (2014) also ranked each leadership approach in relative importance as shown in the last column of table 2.1. Commonality point is that all theories/approaches do interlink, via three macro leadership approaches – authentic, transactional and transformational.

Table 2.1. *Groupings of leadership theories: (adapted from Dinh et al., 2014)*

| Leadership Approaches | References | Theories - Leadership - Overlap | | Ranked (Dinh et al., 2014) |
		Shared Theories (Dinh et al., 2014)	Leadership Overlap (Zhu et al., In Press)	
Authentic Ranked #19 (Dinh et al., 2014)	Avolio & Gardner (2005) Avolio et al. (2004) Gardner et al. (2005) Gardner et al. (2011) Walumbwa et al. (2008)	• Self-determination • Social Identity • Role Incongruity • Social Exchange • Self-discrepancy • Social Learning • Affective Events	Transformational Servant Trait-theory Ethical Abusive Emergent Followership Implicit Identity-based Emotions & Leadership Transactional	1 30 4 19 24 4 5 12 7 10 17
Transactional Ranked #17 (Dinh et al., 2014)	Avolio, Bass & Jung (1999) Bass et al. (2003) Howell & Avolio (1993) Judge & Piccolo (2004) Lowe et al. (2010)	• Social Learning • Social Cognitive • Upper Echelons	Transformational Authentic LMX Servant Shared Ethical Strategic Abusive Spiritual	1 19 3 30 15 19 6 24 28
Transformational Ranked #1 (Dinh et al., 2014)	Bass & Bass (2008) Bass & Riggio (2006) Bass et al. (2003) Bono & Ilies (2006) Bono & Judge (2004) Braun et al. (2013) Conger & Kanungo (1998) Gardner & Avolio (1998) Gong et al. (2009) Howell & Shamir (2005) Judge & Piccolo (2004) Kark et al. (2003) Kirkman et al. (2009) Lowe et al. (1996) Piccolo & Colquitt (2006) Pieterse et al. (2010) Shamir et al. (1993) Tims et al. (2011) Van Knippenberg & Sitkin (2013) Wang & Howell (2010) Wang et al. (2005) Wang et al. (2011) Wu et al. (2010)	• Social Cognitive • Social Exchange • Social Identity • Job Characteristics • Goal Setting • Trait Activation • Upper Echelons	Transactional LMX Servant Shared Ethical Authentic Trait-theory Abusive Emergent Followership Implicit Identity-based Emotions & Leadership Strategic Participative Charismatic Spiritual Entrepreneurial	17 3 30 15 22 19 2 24 4 11 12 7 10 6 15 7 28 37

2.1.2 Authentic Leadership

Authentic leaders inspire the corporate workforce through innovative leadership as part of the process (Tung & Yu, 2016). Authentic leaders push the workforce through new knowledge, greater creativity, innovative ideas, and implementing strategic transformation (Tung & Yu, 2016). Here, leaders dynamically participate in business change processes to achieve positive business outcomes and to deliver corporate transformation (Sow & Aborbie, 2018).

Authentic leadership is considered an emerging leadership approach (Antonakis & Day, 2017). It is value-based, ethical leadership (Fernandez et al., 2011; Zhu et al., In Press), links to creativity (Zhang & Bartol, 2010); and is considered a positive leadership root concept (Avolio & Gardner, 2005; Gardner et al., 2011). Authentic leaders engage decision making analytics for genuine decision makers (Anderson et al., 2017), and is being utilized by some when leading Millennials (digital generation) (Mhatre & Conger, 2012). Avolio & Gardner (2005) find overlap conceptually between authentic and transformational leadership approaches.

The word authentic shows dictionary clarification synonyms including adjectives such as; genuine, original, not a copy, reliable, based on facts, accurate, purposeful, responsible, emotionally balanced, and faithful (Oxford Living Dictionaries, 2018). While it is also understood as being real, true, or what people say it is (Cambridge Dictionary, 2018); and something original and true and not a copy (Your Dictionary, 2018) Thus, an authentic leader *in the digital age*, can likely be viewed as one who genuinely, accurately, based on facts, and purposefully leads corporate's decision making, and one who realistically, faithfully and dependably leads creative mission, vision, and strategic implementation of corporate while instilling trust in the workforce.

As described above, such authentic approaches generate inspiration throughout the workforce (George et al., 2007). In today's digital age this authentic leadership approach embraces new human capital and knowledge support systems around corporate (Jensen & Luthans, 2006); connecting these to strategies management (Ireland, Hitt & Sirmon, 2003).

It pursues positive business outcomes by empowering workforce with new skills sets to execute digital age changes, such as evolving stagnant communication patterns into revolutionary ideas using digital technologies (Lovelace, 2015). Through implementing strategic human capital directional changes particularly bring corporate relationally closer

to its customer base, digital transformation moves closer to achieving its goal (Subramony et al., 2018). Thus, Digital Leadership may involve an authentic approach.

Avolio & Gardner (2005) say authentic leadership typically encompasses amalgamation of interest in greater good of the corporate and is a root construct of many leadership approaches. The theoretical basis of authentic leadership started through humanistic psychology (Avolio & Gardner, 2005); and has now extended to include the position of CEOs maintaining a good moral ethical stance through their career (Wiggins & LaFrenz, 2017). In the digital age this suggests building a position of trust, which is fundamental for change and transformational processes (Agote, Aramburu & Lines, 2015).

When leading, CEOs communicate and display their values through their leadership approach (Vitale, 2017). Further, Vitale (2017) proposes Australian corporate CEOs may have their root construct as authentic leadership, and use transactional and transformational leadership approaches, incorporating these approaches features in combination.

Vitale (2017) suggests Australian corporate CEOs may be viewed as "fair and principled decision-makers who care about people and broader society, and who generally behave ethically in their personal and professional life" (Brown & Trevino, 2006, p. 597), thus demonstrating authentic leadership. Also, CEOs may use authentic leadership in entrepreneurial endeavors including setting strategies in the digital age (Jensen & Luthans, 2006), to achieve digital transformation (Matt, Hess & Benlian, 2015).

Zhu et al. (2011) propose an authentic transformational leadership theoretical model is useful in developing workforce ethical decision making. Furthermore, Vitale (2017) says authentic leaders typically make up to three levels of decisions; economic, legal, and moral. Hence decision making is invaluable digital technique for intelligent analytics, gaining edge over competitors, and planning digital transformation (Ashwell, 2017).

Technology advances in the digital age provide real-time solutions to conveying corporate leadership perspectives to workforce (Colbert, Yee & George, 2016). Consequently, these real-time solutions transform traditional communication methods such as face-to-face, into digital technology connectivities such as messaging, social media, and skype; transforming physical experiences into more psychological experiences of being there in the moment (Colbert et al., 2016). This allows the authentic leader to continually improve preciseness of corporate information and real-time perspectives to workforce (Bounfour, 2016; Gartner, 2016), thus contributing to digital fluency which is important for skills development and setting digital strategies (Colbert et al., 2016).

2.1.3 Transactional Leadership

Transactional leaders focus on setting workforce tone. They balance corporate priorities, and lead to obtain positive results whilst delivering change processes (Baskarads et al., 2016; Sow & Aborbie, 2018). Transactional leadership provides an exchange, contingent rewards and sanctions. It delivers processes whereby the leader attempts to satisfy both corporate and workforce (Gunzel-Jensen et al., 2018). Transactional leaders are attentive towards correcting deviations, and to rectifying and minimizing mistakes (Bass, 1985). Transactional leaders are typically strong organizational managers, providing stability, but retaining a competitive focus (Kark, Van Dijk & Vashdi, 2018).

The word transactional implies enacting or doing. It may be described with dictionary synonyms including: dealing (exchanging or interaction) between people, delivering or conducting business (especially buying or selling) (Oxford Living Dictionaries, 2018b); relating to buying and selling (Cambridge Dictionary, 2018b); and something related to a process or other action, such as a contract, or involving business transactions (Your Dictionary, 2018b). Thus, a successful transactional leader in the digital age, can likely be viewed as one who delivers exchanges through positive (or mixed positive/negative) measurable results, and as one who successfully enacts corporate changes to deliver positive measurable quantifiable successful strategic outcomes (and sometimes failures) for corporate.

Thought to be an exchange, contingent rewards and sanctions process where the transactional leader attempts to satisfy both corporate and workforce (Gunzel-Jensen et al., 2018). There is a close attention to correcting deviations, and to rectifying and minimizing mistakes (Bass, 1985). Transactional leaders are typically strong managers, providing stability, but retaining a competitive focus (Kark et al., 2018).

McCleskey (2014) says transactional leadership evolved for fast, simple transactions to meet marketplace requirements; and suggests transactional leadership meets the marketplace in real-time cost-benefit analysis suits technologies adoption through reciprocity, flexibility and adaptability when setting strategies. While empirical evidence supports transactional leadership as effective, situationally (Bass, 1985; Bass, 1999; Bass, 2000; Bass et al., 2003; Bass & Riggio, 2006; Hater & Bass, 1988; Zhu et al., 2012).

Focusing on work standards, tasks, and compliance using rewards and punishments, hence the term 'transactional' (Odumeru & Ifeanyi, 2013). transactional leadership is described within Full Range Leadership Model, which also includes transformational leadership (Sosik & Jung, 2017). Transactional leaders focus on setting tone for the

workforce offering positive results and stability during transformation processes (Baskarada, Watson & Cromarty, 2016).

Sow and Aborbie (2018) suggest transactional leadership enhance effectiveness of transformational leadership. Consequently, today's digital age preferred leadership approach of corporate CEOs is thought to be reflective of moral judgment using a combination approach (Vitale, 2017). Hence digital trust may ensue relative to how corporate CEOs may influence workforce decision-making processes which is important throughout digital transformation (Vitale, 2017; Matt et al., 2017; Zhu et al., 2011; Zhu et al., In Press).

Linked to above literature, such transactional approaches are investigated as possible process internal and/or external renewal systems creatively through knowledge sharing (Hussain et al., 2017), and seek to generate measurement internal operational change processes across corporate (Hussain et al., 2017; Pearce, 2004).

These normally target some form of perceived corporate internal and/or external improvement. Transactions may arise through horizontal or vertical communicative exchanges between workforce personnel, or through virtual (digital or intangible) and/or physical (real-world or tangible) exchanges and/or interpretations (Lord et al., 2017; Pearce, 2004).

Transactions may implement corrective operational actions such as enhancing corporate decision-making systems or improving corporate precision (Vitale, 2017). As digital age leadership likely seeks improvement in a corporate's business and/or competitive positioning, transactional leadership is likely involved (Hiekkanen, 2015).

Transactional leaders promote digital sales and marketing to expand revenue growth through building brand identity (Morhart, Herzog & Tomczak, 2009). They do this through motivating workforce, appealing to contingency rationale. Consequently, this allows business to align and transact directly with customers in competitive markets such as the digital age, because corporate develops a clear brand identity (Ghodeswar, 2008).

Transactional leaders in the digital age ensure their workforce is digital savvy and flexible for rapid learning digital technologies to use in digital transformation and they achieve this through digitally focused learning and development programs (Arkhipova & Bozzoli, 2017; Harvard Business School Publishing, 2018). Transactional leaders motivate their workforce inspiring them towards benefiting customer relationship management (CRM) through reward measures (Akinbode & Al Shuhumi, 2018; Barbuto, 2005).

2.1.4 Transformational Leadership

Setting an example for others, the transformational leader likely engages corporate through a shared vision and can inspire and motivate process successes in workforce (Holten & Brenner, 2015; Sow & Aborbie, 2018). They can also empower creativity.

Gunzel-Jensen et al. (2018) describe transformational leadership as a most influential contemporary leadership theory (p. 958). Visionary and innovative (Judge & Piccolo, 2004), transformational leaders listen to workforce concerns (Bass, 1985) and inspire them (and corporate leadership) to innovate (Judge & Bono, 2000), and/or to change processes, and/or transcend self-interest, and/or deliver creative ways continually advancing corporate transformation (Seltzer, Numerof & Bass, 1999; Yukl, 1989; Judge & Bono, 2000).

Transformational leadership suggests a substantive corporate change (or renewal) is being enacted. The word transformational shows dictionary clarification synonyms including: alteration, change in form, nature or appearance, a metamorphosis, conversion, modification (Oxford Living Dictionaries (2018c); big change or improvement (Cambridge Dictionary, 2018c); and process of being transformed and changed (Your Dictionary, 2018c). Thus, combined with above research, the transformational leader *in the digital age*, can likely be viewed as one who brings innovation and inspiration to the corporate, and then revolutionarily converts and alters and/or realign corporate into a new digital age competitive entity.

Transformational leaders may provide inspiration, vision, innovation, motivation, and creativity for others to be successful (Holten & Brenner, 2015). Furthermore, they appear to role model to others what success looks like; and contribute to desired outcomes of digital transformation (Sow & Aborbie, 2018).

Seyal (2015) found significant correlation between transformational leadership and technology adoption; and Ferreras Mendez, Sanz Valle and Alegre (2016) found transformational leaders encourage knowledge acquisition, retention and sharing. Further, Lin and Chen (2017) found transformational leaders significantly influence positive technologies innovation and adoption.

Furthermore, Transformational business-reinventing leaders exert an idealized influence (Buchanan & Badham, 2008), provide inspiration (Bycio, Hackett & Allen, 1995), imbue intellectual stimulation (Korhonen, 2015), and exert individualized considerations (Bass & Rigio, 2006) across corporates business transforming options (Sow & Aborbie, 2018). These are important factors for engaging workforce in successful digital transformational

strategies (Sow & Aborbie, 2018); and important factors for empowering workforce potential to achieving a higher attitude (Lovelace, 2015).

This type of Digital Leader empowers both corporate innovative (Gunzel-Jensen et al., 2018) and new research (Hoch et al., 2018) and its competitive creative-newness of the workforce (Eisenbeiss & Boerner, 2013). It digitally alters and revolutionizes corporate moving it towards an envisaged, more-competitive, corporate life-cycle initiation (Lopes de Sousa Jabbour et al., 2018).

It breaks new ground as it investigates a previously unknown raft of possible useful external and internal innovations, and new technologies options (Howell & Higgins, 1990). These can involve digital capabilities - such as cloud data repository data security, artificial and business intelligences, Industrie 4.0 rebuild approaches, and emergent discoveries (Lopes de Sousa Jabbour et al, 2018). These approaches are considered as possible corporate-wide implementation solutions.

Transformational leaders innovatively change business processing systems through creative and novel solutions and through developing a promotion focus in their workforce (Kark et al., 2018). Achieved through focusing on the ideal workforce self, this helps workforce to heighten their promotions focus level, thus connecting motivation for innovation.

Playing an important role as information provider, ensuring overall organizational vision is achieved, transformational leader's use communication to build enthusiasm for corporate future (Mohamad et al., 2018). Therefore, transformational leaders may want to build smarter internal business communication systems for distributing correct information while connecting workforce direction.

Going beyond every day management of operations, transformational leaders focus on strategies for taking corporate to next level of performance success and in the digital age this may involve reinventing business processes (Loh, Mohd Yusof & Lau, 2018).

Here, the transformational leader links organizational values to workforce so they may identify and enhance workforce commitment to goals for growth of corporate including digital transformation in the digital age, through values and vision (Loh et al., 2018). Consequently, leaders seek workforce buy-in for decisions made including opportunities for growth such as reinventing business processes and for greater good of the corporate to evolve.

2.1.5 Proposed Digital Leadership Framework

In summary, *authentic leadership* captures corporate human capital and related knowledge systems, *transactional leadership* captures decision making, and actioning, towards internal and/or external corporate systems renewal, and *transformational leadership* captures the corporate's revolutionarily ability to digitally innovate and reframe into a very-competitive, globally-viable, digital age position. Hence, corporate Digital Leaders of today likely encompass mixes of these three macro leadership approaches.

Avolio and Gardner (2005) find overlap conceptually between authentic and transformational leadership approaches. Hoch et al. (2018) also finds correlations between authentic, transformational and transactional approaches with significant conceptual overlap. Hence, when developing a Digital Leadership approach, it is likely digital age authentic, transactional and transformational leadership approaches may each interplay and display some overlap (Zhu et al., In Press).

Consequently with support authentic, transactional and transformational leadership approaches share considerable overlap (Avolio & Gardner, 2005; Hoch et al., 2018; Zhu et al., In Press) (See Table 2.1); and suggestion these three leadership approaches may be used in combination (Gunzel-Jensen et al., 2018; Vitale, 2017; Zhu et al., In Press), this research suggests these three leadership approaches in combination support a Digital Leadership framework.

2.2 Framework of Digital Leadership

Hence, this study proposes a Digital Leadership framework may encompass aspects of all three macro leadership approaches (authentic, transactional, and transformational). This overlapping framework of Digital Leadership demonstrated in figure 2.1 considers that in today's digital age, authentic leadership for example can be pure, or can overlap with either transactional leadership, or transformational leadership. There is also a case where all three leadership modes co-exist and overlap.

Thus, in considering Digital Leadership options there are many approaches that can and may exist. In general, it is likely best leadership approach in the digital age is a combination of leadership approaches, but this requires a very broad leadership strategies and digital skills set, with easiest but less radical digital changes occurring within pure zones, and most complex digital transformations occurring at the framework's apex, capturing the three overlapping leadership approaches.

Digital Leadership is described by Sow & Aborbie, (2018) as exertion of influence for adopting strategies for demonstrated digital transformation processes. Further they add adoption of transactional, transformational and other leadership approaches can lead to successful results in the implementation of large scale digital. Thus, they relate Digital Leadership as a combination of leadership approaches and when implemented can initiate a disruptive, large scale digital transformation process.

Table 2.1 lists key ranked leadership approaches within three macro leadership approaches. It also shows dual or tertiary theory overlaps exist. In figure 2.1 dual approach or secondary overlaps are also theoretically supported (Avolio et al., 1999; Avolio, & Gardner, 2005; Burns, 1978; Gunzel-Jensen et al., 2018; Zhu et al., In Press) as shown. Further table 2.1 adds there is also support for a tertiary overlap between these macro leadership approaches (Avolio, Bass & Jung, 1999).
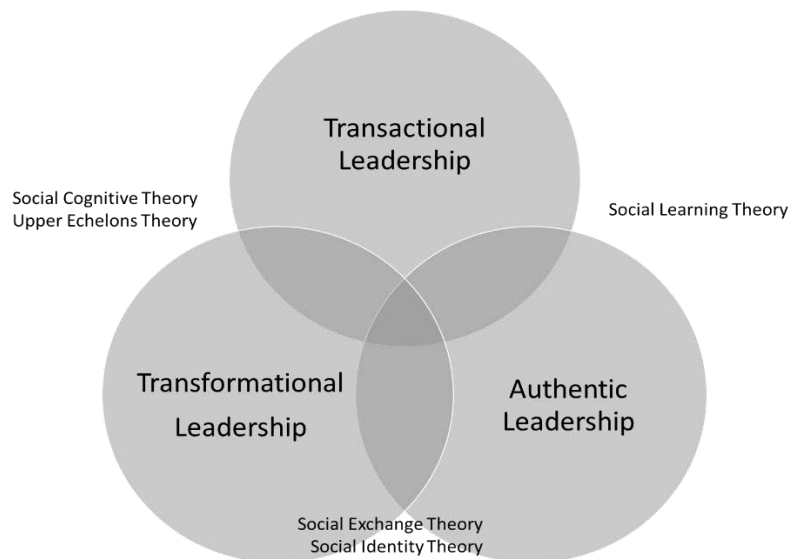
Figure 2.1. Digital Leadership Framework Approach

2.2.1 Importance of Macro Leadership Approaches Today

Between years 2000 and 2012, 752 leadership theory papers emerged in 10 top tier journals – with transformational leadership ranking number one (154 papers), transactional leadership ranking 17th (35 papers) and authentic leadership theory ranked 19th (31 papers) (Dinh et al., 2014). However, other leadership approaches in between these above three rankings, align across or within these three macro leadership approaches considered herein (See Table 2.1). Hence, this study considers three macro leadership approaches as a suitable leadership mix from which today's digital age leadership may be better understood.

Avolio et al. (2009) and Dinh et al. (2014) also provide evidence authentic, transactional and transformational leadership approaches are foundations on which other leadership approaches can be seen to be developed. Sosik and Jung's (2017) Full Range Leadership Model also links many other leadership theories/approaches as fitting within transactional leadership or transformational leadership approaches.

Further, a recent Google Scholar search (11/09/2018) by this study's author reveal the words authentic leadership returning 579k results, transactional leadership returning 140k results and transformational leadership returning 364k results, as currently appearing over 579K, 140K and 364K times respectively. The recent global usage of these three leadership approaches, support these as currently recognizable as i*nternationally important in the digital age*, and therefore likely associated with Digital Leadership approaches.

Hence, this study recognizes these three macro leadership approaches are relevant leadership approaches when investigating today's digital age leadership.

2.2.2 Digital Leadership

Gartner (2018) says, "Digital Leadership is the preferred corporate leadership approach to lead in the digital age". Digital Leadership is described by Sow & Aborbie (2018) as demonstration of strategies adoption positively influencing digital transformation processes. They further add, adoption of transactional, transformational and other leadership approaches can contribute successful competitive results when implementing large scale digital transformation. Thus, they perceive Digital Leadership as a combination of leadership approaches, which when implemented, can lead to a disruptive, large scale digital transformation process across corporate.

Beresford (2018) argues there are currently four business-enabling models applicable to digital age. These are; (1) human collaboration (where CEOs workforce become a united, authentic team), (2) orchestration (where CEOs shared transactional leadership approach has a greater impact on team performance and productivity), (3) creation (where CEOs innovation inclusions deliver a transformational approach) and (4) matching (where a copy-others approach is deployed).

Beresford's (2018) business-enabling models relate to three leadership approaches discussed herein this thesis. Again, suggesting Digital Leadership may incorporate multiple leadership approaches. Here, the same three leadership approaches are likely involved in delivering Digital Leadership.

Sia, Soh and Weill, (2016) case study of Singapore's DBS Bank and its recent re-engineering into digital business. DBS's corporate leaders described how they delivered leadership through a digital transformation approach. Operationally, they engaged an agile and scalable digital analytics approach to increase dynamism of their business, and so deployed a transactional leadership approach. They leveraged their data channels through dynamic digital connectivities enabled new customer experiences, and so utilized an authentic leadership approach.

They accelerated pace of innovation and incubated emergent digital innovations as their corporate's new technologies solution, and so used a transformational leadership approach. This combination of leadership approaches then enabled DBS's corporate leadership to successfully pursue a digital business strategy, thus engaging their newly developed digital skills set. These two corporate Digital Leadership outcome solutions (strategy and skills) jointly helped achieve a desired corporate-wide digital transformation for the DBS Bank.

Thus, a combination of leadership approaches is again likely deployable to meet new, pressing and diverse strategic and skills transformation requirements the digital age brings to corporate environments (Harvard Business School Publishing, 2018). Hence, this study uses an Australian corporate CEO perspective, multi-leadership approach (authentic, transactional and transformational) to investigate Digital Leadership. It also investigates how Australian corporate CEOs likely engage key available digital imperatives (analytics, connectivities and technologies) to respond and to move towards delivering corporate CEOs digital transformation outcomes through digital strategies and digital skills.

Figure 2.2. Digital Leadership Framework

2.2.3 A Caution Regarding the Figure 2.2 Digital Leadership Framework

Transactional and transformational leadership have been proposed along a continuum (Bass, 1985); with transactional capturing rewards, constructive transactions, management by exception and corrective transactions; and further along the continuum transformational captures charisma, individualized consideration, inspirational motivation and intellectual stimulation. This approach assumes leadership to be a linear range.

However, pure authentic leadership in the digital age may arise when corporate does not engage transactional or transformational leadership. Further, as digital age leadership approaches may overlap these three leadership approaches can possibly operate in a three-dimensional space.

Again, this provides another question - 'can Digital Leadership exist when authentic, transactional and transformational leadership do not apply.' This suggests current leadership approaches in the digital age may be even more complex and may involve a possible fourth dimension or multi-dimensional approach. This also assumes we can describe Digital Leadership in terms of existing leadership approaches.

For this research, and at this point in-time in understanding Digital Leadership, this study adopts a three-dimensional leadership approach to attempt to explain Digital Leadership. This study cautions this approach contains a scope-limiting aspect to Digital Leadership, but this study does advance current Digital Leadership research. Hence, beyond this study, this digital age, multi-dimensional, corporate CEO leadership approach remains area for further future leadership research, and for ongoing framework – particularly as further disruptive refinement to digital imperatives, and digital transformations arise. These may further influence corporate CEOs digital transformation considerations.

2.2.4 Digital Imperatives

Many researchers describe technologies; social, mobile, analytics, cloud, and internet of things (IoT) (SMACIT) reality (Ross et al., 2016; Sebastian et al., 2017; Slagmulder, Cumps & Dillen, 2018). However, such acronym excludes other emerging digital technologies such as artificial intelligence, block-chain, robotics, and virtual. The digital imperatives referred to in this research include all above mentioned technologies and are reduced to three broad themes; analytics, connectivities, and technologies (Sia et al., 2016; Simoes, Barbosa & Filipe, 2018; Yablonsky, 2018).

Sia et al. (2016) conclude a corporate Digital Leadership approach was used in delivering digital transformation of the DBS Bank. They say, Digital Leadership can deliver digital strategic solutions include: a strong multi-faceted leadership approach, along with digital imperatives of; scalable and agile deployed digital infrastructure/platforms (technologies), extraction (connectivities) and exploitation (analytics) of information from clouds of available data (which then may contribute to added consumer value), and ongoing incorporation of emergent innovations (analytics, connectivities, and technologies).

Sia et al. (2016) Digital Leadership strategic solution is corporate-wide. It collectively flows from a set of digital imperatives; (1) align corporate structures and develop advanced corporate processes (analytics), (2) build an optimized, connected corporate workforce (connectivities) and (3) incorporate new innovative technologies across corporate (technologies).

Sow & Aborbie (2018) support Sia et al., (2016) saying corporate CEOs institute a Digital Leadership approach to the pathway delivering digital transformation processes which likely does involve an intermediate digital imperatives step. These two group researchers link a combined authentic, transactional and transformational combined leadership approach (their Digital Leadership approach) through to sets of digital imperatives and then through to a set of digital outcomes.

Danoesastro, Freeland and Reichert (2018) suggest today's corporate CEOs should carefully assess how to harness emergent digital imperatives such as: how to apply new ways of collaboratively working, how to deliver new levels of personalized customer servicing (analytics and connectivities), how to incorporate new digital technologies and platforms (emerging technologies) for digital transformation. These corporate CEOs should pursue a broad strategy for change and drive purpose of change, course-correcting where necessary.

This adaptive leadership approach fits within the broad transformational leadership approach (Danoesastro et al., 2018). Here, leaders sieve vast quantities of digital imperatives, manage accelerating innovation cycles, and reshape their corporate into an agile, adaptive business. Today digital transformation is everywhere and on agendas of corporate boards and is now at the top of CEOs strategic plans (Siebel, 2017).

Thus, Digital Leadership likely fits across components of each of the three broad leadership approaches of table 2.1 (authentic, transformational and transactional). Here, leaders sieve vast quantities of digital initiatives for solutions (analytics), reshape their corporate into an agile, adaptive business (connectivities), and manage accelerating innovation cycles (technologies).

Over-time these combined approaches deliver corporate's digital transformation agenda (Siebel, 2017). This Digital Leadership approach is now considered universal and is near the top of today's corporate CEOs' strategies.

Digital Leadership is also customer focused, and this engages both technology and human interface insights (Westerman, 2018). Thus, leaders must inspire and rewire workforce culture and talent into a new way of thinking/collaborating/connecting. Hence Digital Leaders must typically act, counter, and think differently than traditional leaders. (Abbatiello, Philpot & Roy, 2018).

2.2.5 Digital Transformation

Today's corporate CEOs operate in the digital age, and in a global Industrie 4.0 competitive environment. Industrie 4.0 is the digital age 4th industrial revolution (German Trade & Invest, 2017). It is reframing competitive global business landscapes and forcing today's corporate CEOs to reposition their business to a globally competitive entity. Hence there are also global digital imperatives driving corporate towards implementing digital transformations. Prioritizing today's corporate digital imperatives are not generally understood; however, they are linked to corporate CEOs digital transformation targets, and these are found in CEOs corporate strategies and corporate new skills set requirements (Gimpel et al., 2018).

Some corporate CEOs reconceive their corporate futures against digital reinvention (Berman & Dalzell-Payne, 2018). They measure today's digital investments against tomorrow's perceived new digital context (Berman & Dalzell-Payne, 2018). This digital transformation encompasses new digital strategies and new digital skills outcomes (Bolden & O'Regan, 2016; Nally, 2016; Whitehurst, 2015).

These digital transformations are delivered through adopted digital imperatives (Dasi et al., 2017). Again, Digital Leadership approaches likely link to digital imperatives, and these, in-turn, then deliver digital transformation.

Harvard Business School Publishing (2018) suggest corporate CEOs as leaders, currently display a digital skills gap. It was found CEOs generally have insufficient capabilities to engage with latest innovations, and lack knowledge to strategically drive the corporate's digital age competitiveness.

2.3 Digital Leadership Drivers

This study proposes when corporate CEOs initiate a corporate-wide disruptive digital transformation, this leader likely draws combinations of authentic, transactional, and transformational leadership approaches to influence said digital transformation.

New competitive strategies are redefining existing business models. From 2010 to 2020, around three quarters of Standard & Poor's top 500 are projected to be new entities (Harvard Business School Publishing, 2018). In 2018, today's most successful US corporates are considered bimodal. They excel at (1) executing and incorporating 'what's new,' whilst (2) maintaining 'the old' successful, continually-improving, existing operations (Harvard Business School Publishing, 2018). Further, US corporates today pursue delivering highest-quality new digital skills to address latest corporate digital strategies are typically best performers in their industry category (Harvard Business School Publishing, 2018).

This Harvard Business School Publishing (2018) survey add corporate CEOs focusing on continually developing their digital skills and digital strategies, are now 29 times more likely to deliver a successful corporate transformation (Harvard Business Publishing, 2018). Danoesastro et al. (2018) and Seibel (2017) both add successful digital transformations involve top down approaches (personally driven by CEOs), and these involve engineering massive digital age corporate changes - particularly in response to new technologies drivers.

Siebel (2017) believes corporates are entering highly-disruptive, potential-extinction events - where many corporates fail to transform shall disappear. The Harvard Business School Publishing (2018) report, states (1) many new (and unanticipated) corporates shall emerge and (2) other existing ones shall transform under new business models.

This forces CEOs to rethink their corporates' execution with new digital imperatives including; (1) new business processes, (2) new management practices, (3) new information systems plus (4) everything about their customer/consumer relationships. Hence corporate CEOs need to articulate their broad purposeful strategies along with their emergent digital age skills drivers (Danoesastro et al., 2018).

The above suggests today's corporate CEOs likely target becoming; (1) more agile and (2) more capable of adapting quickly to ongoing digital/competitive forces changing their global business environment. Hence, corporate CEOs likely push a rapid top-down leadership-change approach pushes their perceived global digital imperative drivers into corporate, and so generate competitive pathways engagement mechanisms help reach

desired corporate transformation outcomes, (and circumvent potential ongoing disruptive external threats towards corporate).

Hence, this study proposes when Australian corporate CEOs propose to initiate digital transformation, this leader likely uses a combination of top down authentic, transactional, and transformational leadership approaches. Thus, a corporate CEO Digital Leadership Conceptual Model can likely be framed first as a combination of three macro leadership approaches.

This combination then forms drivers of a set of corporate digital imperatives. These digital imperatives in-turn then influence a set of corporate digital transformation outcome drivers (digital strategies & digital skills). This Digital Leadership Conceptual Model, which is now being proposed, is illustrated below.
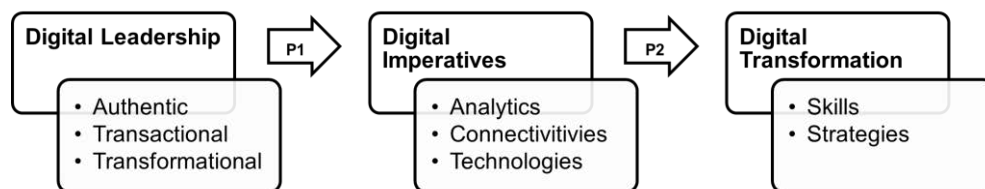
Figure 2.3. Digital Leadership Conceptual Model

The Digital Leadership Conceptual Model allows three different corporate CEO leadership approaches to be visualized together as an independent digital age leadership construct from which a suite of perceived digital imperatives can be prioritized and engaged as enabled to deliver the new digital age suite of desired digital transformation outcomes.

The left side path linkage proposition arrow (P1) can be viewed through structuration theory where active constituting processes are accomplished by doing active things (Parker, 2000). Here, corporate CEOs digital imperatives are actively engaged in combination as systemic forms (Giddens, 1984). The workforce then engages and carries out necessary corporate reproduction of social actions/practices (Stones, 2005).

P1 and P2 are also captured via adaptive structuration theory (DeSanctis & Poole, 1994; Poole & DeSanctis, 2002). Sinclaire and Vogus (2011) suggest adaptive structuration theory links social structures (our Digital Leadership framework) and interactions with new technologies (our digital imperatives) to create a technologies-in-use solution (our digital transformations) may advance corporate.

Further, Pozzebon and Pinsonneault (2001) suggest adaptive structuration studies orient towards prediction, and to delivering outcomes (or consequences) of interactions between technologies and interacting corporate drivers. Adaptive structuration theory also provides corporate change directions leading today's digital transformation processes (DeSanctis & Poole, 1994).

Here, the workforce first produces (and specifically reproduces) required corporate systems by applying usage of rules and resources in their interactions. This top-down approach fits P1. DeSanctis and Poole (1994) adapt Giddens' (1984) structuration theory to study workforce and corporate interactions against advanced information technologies (AIT), and therefore understand use of digital imperatives.

In adaptive structuration theory (and within Giddens (1984) structuration theory), both corporate systems and corporates structures exist in duality with users deploying specific technologies rules/resources/norms, within specific appropriation contexts to capture beneficial aspects of corporate's causal outcomes systems (Carroll et al., 2002; DeLone & McLean, 1992). Hence, information quality (analytics and connectivities) and system quality (technologies) each produce/reproduce ongoing intelligent cyclic corporate and workforce outcome successes. These are measured against corporate digital strategies, and new digital skills achievements.

Further, institutional theory adds links between technologies and enactments of these technologies to deliver outcomes (Tolbert & Zucker, 1996). Considering corporates as institutions, and links between technologies and enactments are corporate processes this link delivers digital transformation outcomes. Hence, institutional theory fits across both P1 and P2 proposition arrows.

The right-hand linkage proposition arrow (P2) can also be viewed through user-gratification theory and as delivering reflective outcomes (Shao, 2009). It also fits within social networks theory and human agency theory (Nevo, Nevo & Pinsonneault, 2016). Here, analytics, connectivities and technologies induce corporate internal change, and where enacting these technologies can then induce corporate outcomes changes

Finally, from a corporate management viewpoint 'management fashion theory' can explain how Digital Leadership influences digital imperatives. Management fashion theory describes a perceived need to adopt an innovation (Madsen & Stenheim, 2016; Sinclaire & Vogus, 2011). In the digital age Industrie 4.0 is becoming a mainstream digital transformation change driver. From MFT perspectives Digital Leadership is likely to recognize this imperative.

Hence, this research proposes P1 – ***Digital Leadership influences digital imperatives.***

Similarly, from AST perspectives uptake of digital imperatives likely alters corporate's performance outcomes (DeSanctis & Poole, 1994). These outcomes arise with corporate's digital transformation. Within this transformation digital capabilities and technologies artifacts are modified and treated through change processes. Here, this study identifies digital strategies and digital skills as key digital transformations (Schmitz, Teng & Webb, 2016).

Hence, this research proposes P2 – ***digital imperatives influence digital transformations***.

To investigate figure 2.3 Digital Leadership Conceptual Model, this research now operationalizes this conceptual model into a full structural equation model, which this research calls the Digital Leadership Research Model.
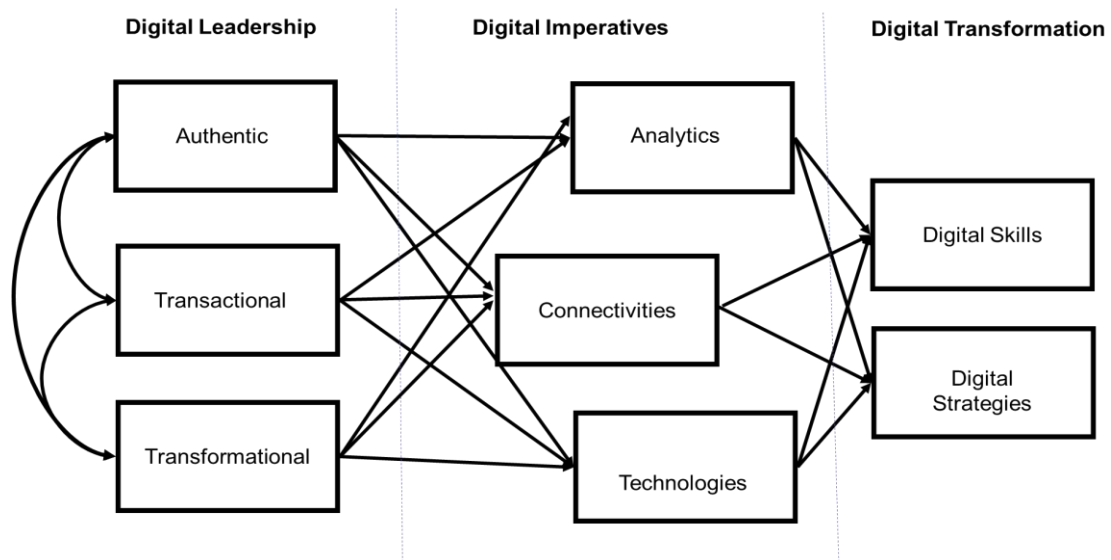
Figure 2.4. Digital Leadership Research Model

Hence, Digital Leadership Research Model (see Figure 2.4) is likely a valid approach for investigating the Digital Leadership of Australian corporate CEOs.

2.4 Chapter Two Summary

This chapter builds a Digital Leadership framework (See figure 2.1) and Digital Leadership Conceptual Model (See Figure 2.3). This framework and model shape this thesis' research study approach. The research approach maps these three sequential areas; Digital Leadership, digital imperatives, and digital transformation. It further demonstrates how Australian corporate CEOs Digital Leadership approaches can deliver a corporate digital transformation.

Finally, chapter two proposes this research approach for testing with development of a Digital Leadership Research Model. Hence, chapter three discusses the methodologies required to implement the Digital Leadership Research Model.

3.0 Chapter Three - Methodology

3.1 Introduction

To understand propositions put forward in chapter two, chapter three explains this research's methodological approach. Explanations in this section include survey role, semi-structured interviews, data capture and analysis.

Collected data, quantitative and qualitative in structure, intend to ascertain whether Digital Leadership influences digital transformation using digital imperatives and if so, how. Perspectives of Australian corporate CEOs in collected data are interpreted, enabling more comprehensive understanding of findings.

3.2 Research Methodology

3.2.1 Research Approach

The post-positivist paradigm adopted within this research (Kivunja & Kuyini, 2017) explains reflected research beliefs about the world this researcher chooses to live and wants to live in. Answers to questions are guided by four criteria of ethical considerations namely, teleology, deontology, morality and fairness (Mill, 1969).

Therefore, this research is conducted using ethical conduct, with all humans having the right to dignity, respect, and fundamentally the right to make choices (Kivunja & Kuyini, 2017). Furthermore, this research upholds following ethical principles with respondents and data; privacy, accuracy, property, and accessibility; and these should ensure data collection is safeguarded when gathered and analysed.

3.2.2 Methodological Approach

The Digital Leadership Research Model (See Figure 2.4) facilities empirical testing of theoretical relationship pathways extracted from literature and propositions presented in chapter two. To test this model, data are collected using an on-line survey and semi-structured interviews.

On-line surveying includes both quantitative and qualitative methods grounded in post-positivist paradigm enquiry of phenomena (Kivunja & Kuyini, 2017). This perspective underlies deductive method with demonstrated propositioned relationships (Garson, 2015). Such proposed relationships are used to quantify observable consequences by running statistical analyses for obtaining results testing whether these proposed relationships hold or not (Garson, 2015).

Cooper and Schindler (2001) interpret causal propositions as directional and use the nature of constructs under investigation. Causal proposition testing is suitable for mature scientific application, especially when research approach aims to match assumptions underlying scientific observations (Kuhn, 1970).

From an objective prospective, this research scientifically and statistically answers the research question. This research therefore, holds inherent limitations, and does not reveal potential individual phenomena, except for semi-structured interviews.

3.3 Sampling Procedures

This research focuses on sampling Australian corporate CEOs. Each potential respondent participates in on-line survey research through invitation. The survey initiates through a hyper-link in the invitation, opening to a Survey Monkey (www.surveymonkey.com) survey. Considered appropriate for data collection, Survey Monkey is a digital tool considered in this research against a connectivities digital imperative.

Standard and sophisticated statistical analysis, including structural equation modelling (SEM), recommend a sample of twenty cases per construct (Hair et al., 2010) to test SEM path models. An adequate sample size is therefore required to assess significance of the Digital Leadership Research Model SEM path model.

To maximise survey response rate, Dillman (1978 & 1991) recommends up to seven reminders should be administered to potential respondents. This suggestion is used in participant recruitment to maximise responses.

This researcher connects with potential respondents on social media platform LinkedIn (www.linkedin.com). The survey hyperlink is provided to LinkedIn connections, who are then invited to participate in the 15-minute survey. The survey is made available for four months from 1st October 2017 to 31st January 2018.

The on-line survey has three distinct steps. The first step focuses on measuring the Digital Leadership Research Model constructs through quantitative analysis, second step focuses on capturing respondent generalized information such as age, education, gender and position. Third step collects qualitative data aimed at supporting the Digital Leadership Research Model through captured opinions.

Data are collected from 309 respondents. One hundred and forty-four responses are rejected due to incompletion. The research sample size is N=165. Therefore an adequate sample size is obtained (Hair et al., 2010).

3.3.1 Analysis Unit

Analysis unit aggregates levels investigating data collected. This can be individual, discipline or community (Sekaran & Bougie, 2013). As mentioned in Chapter two, there are ten main theories (authentic, transactional, transformational leadership theories; structuration theory, adaptive structuration theory, institutional theory, user-gratification theory, social networks theory, human agency theory and management fashion theory) used to investigate the Digital Leadership Research Model. However within the Digital Leadership Research Model there are eight constructs under investigation in this research.

3.3.2 Measuring Constructs

Previous research suggests in behavioural research, common method variance can significantly impact observed relationships between criterion and influencing constructs (Podsakoff et al., 2003). Although strength of impact estimates of common methods biases varies, their average level may be substantial.

Firstly, to minimize maturation bias (time effect bias), all independent construct, intermediate constructs, and dependent constructs are collected simultaneously (Hair et al., 2010). This research survey is designed to be completed within 15 minutes.

Secondly, to reduce measurement bias, this research adapts literature-defined measurement constructs used in previous research. Furthermore, to improve consistency, all construct measures use the same 5-point Likert scale and the survey includes open-ended questions asking Australian corporate CEOs opinions. Furthermore, collected demographic information is used to validate collected data against published data.

For measurement construct validity and reliability, this research uses procedures recommended by Nunnally and Bernstein (1994). Content validity improves subjective assessment of scale measures (Malhotra & Birks, 2007).

Each construct is well defined and measured according the Digital Leadership, digital imperatives and digital transformation domains. For this research, the Digital Leadership construct measures are derived from previous studies and have exploratory reliability greater than 0.6 (Hair et al., 2010).

As this is exploratory research and there are no existing measures for items measuring digital imperatives and digital transformation, the approach of understanding construct development process to establish validity and theoretical rigour is used (Recker & Rosemann, 2007). Relevant IS research domain example, is business process modelling,

and therefore useful in developing a scale measurement of various perceptions toward digital imperatives and digital transformation digital strategies and digital skills Australian corporate CEOs may have.

3.4 Pilot Study

To validate content, previous research and literature are reviewed. Measures are adapted from previous literature research and reframed into this research draft survey. After piloting the draft survey, minor adjustments are made to structure and content, before publishing on-line.

The pilot is conducted with four senior James Cook University academics and four corporate leadership professionals, who make suggestions and recommendations incorporated into final survey.

This chapter discusses detailed conceptual and operational definitions, proposed relationships, and measurement domains. Digital Leadership Research Model construct measures are discussed further below (and in Appendix C).

3.5 The Digital Leadership Research Model Constructs

3.5.1 Digital Leadership - Authentic Leadership

Measurement of authentic leadership construct modifies Authentic Leadership Questionnaire (ALQ) items (Walumbwa et al., 2008, pp. 121). Together with items from a Harvard Business Review report on driving digital transformation (Whitehurst, 2015) and applying statements relating to potential respondents' views about their corporate leadership to maximise usable responses. The developed survey asks respondents to rate six questions to extent (disagreement or agreement) to which they believe their leadership provides features described in the statement.

An example of item adaption is question number one, "As a corporate leader, I continually improve the preciseness of our corporate's information". This item is initially part of the Walumbwa et al. (2008) ALQ, which states as "I listen closely to the ideas of those who disagree with me." It measures balanced processing and assesses the leader's continual focus of improving efficiency and effectiveness through challenging ideas from others. Inspiration for adapting this item comes from Whitehurst (2015) measurement item "Digital Leaders should teach workforce digital trends in information sharing".

Therefore, the authentic leader measurement item number one in this research emerges through a combination approach to merging the above two examples (Walumbwa et al., 2008; Whitehurst, 2015).

Further information on construct measurement item development can be found in Appendix C.

The survey items are displayed below.

As a corporate leader I;

1. Continually improve the preciseness of our corporate's information.
2. Precisely convey corporate leadership perspectives to our workforce.
3. Am focused on real-time solutions.
4. Determine our minimum workforce required
5. Strategically rationalize our management levels
6. Use my core beliefs to further specialize our business

3.5.2 Digital Leadership - Transactional Leadership

The transactional leadership construct modifies Multifactor Leadership Questionnaire (MLQ) 5X-Short Form measurement items (Northouse, 2010, p. 213), and items from a Harvard Business Review report on driving digital transformation (Whitehurst, 2015) and applies them to Australian corporate CEOs leadership to maximise usable responses. The survey asks respondents six questions.

An example of item development is question number one, "As a corporate leader I, promote digital sales/marketing to expand our revenue growth". This item is initially part of Northouse (2010) Transactional Leadership measurement, which is sourced from the MLQ (Bass & Avolio, 1995). This item adapted from "I keep track of all mistakes" (Northouse, 2010), and "through failure leaders understand how to improve sales/marketing revenue" (Whitehurst, 2015). This item measures (incentives) and uses mistakes to improve performance. Inspiration for adapting this item comes from Whitehurst (2015) Digital Leadership perspective of sales/marketing strategies promoting revenue growth, and transactional leaders manage people, and put in place processes and technologies to execute strategy.

Therefore, the transactional leader measurement item number one in this research emerges through a combination approach to merging the above two examples (Northouse, 2010; Whitehurst, 2015).

Further information on measurement item development can be found in Appendix C.

The survey items are exhibited below.

As a corporate leader I;

1. Promote digital sales/marketing to expand our revenue growth.
2. Allow our business to align and transact directly with our customers.
3. Ensure my workforce is digitally savvy and flexible.
4. Motivate my workforce towards benefiting our customers.
5. Negotiate productivity with my team.
6. Provide recognition when others are reaching my goals.

3.5.3 Digital Leadership - Transformational Leadership

Transformational leadership measured by modifying MLQ 5X-Short Form sample items (Northouse, 2010, p. 213) and items from a Harvard Business Review report on driving digital transformation (Whitehurst, 2015) so they apply to Australian corporate CEOs leadership to maximise usable responses. The developed survey asks six questions.

An example of item development is question number one, "As a corporate leader, I innovatively change our business processing systems". This item is initially part of Northouse (2010) Transformational Leadership measurement, which is sourced from MLQ (Bass & Avolio, 1995). This is adapted from combining "I talk and behave optimistically about the future" (Northouse, 2010), and "Digital Leaders paint a picture of the digital future to innovate changing business processes" (Whitehurst, 2015). This item measures inspirational motivation, communicating vision while building potential; assessing leader's ability to articulate a compelling vision.

Therefore, transformational leadership measurement item number one in this research emerges through a combination approach to merging the above two examples (Northouse, 2010; Whitehurst, 2015).

Further information on measurement item development can be found in Appendix C.

The survey items are displayed below.

As a corporate leader, I;

1. Innovatively change our business processing systems
2. Always build smarter internal business communication systems
3. Reinvent our business processes
4. Drive new innovations into our product offerings

5. Seek emerging new technologies to create new business opportunities
6. Proactively seek new opportunities to advance our business boundaries

3.5.4 Digital Imperatives Constructs

3.5.4.1 Analytics

Analytics construct is measured by adapting analytics characteristics from a Harvard Business Review Report on driving digital transformation (Whitehurst, 2015) with suggestions operationalising analytics (Sia et al., 2016) so they apply to Australian corporate CEO leadership. The developed survey asks respondents to rate six questions indicating disagreement or agreement of believe their leadership provides features described in the statement.

An example of item development is question number one, "To enhance our strategic performance, I use data analytics to broaden our customer transactions". As there are no existing measures for this analytics construct, these measurement items are adapted (Whitehurst, 2015) to leaders using analytics to predict corporate direction to enhance strategic performance (Sia et al., 2016). Items are developed according to literature writing questionnaire items process (Korb, 2012). This item is adapted from "Understanding customer needs through data collection and analysis" (Whitehurst, 2015; Sia et al., 2016).

Further information on measurement item development can be found in Appendix C.

The survey items are exhibited below.

To enhance our strategic performance, I use;

1. Data analytics to broaden our customer transactions.
2. Data analytics to enhance our customer intelligence.
3. Strategic road-map to develop our big data analytics capabilities.
4. Digital capabilities to monitor competitors.
5. Our real-time digital dashboard indicators to refine business priorities
6. Digital channels to collaborate with our stakeholders.

3.5.4.2 Connectivities

The connectivities construct is measured through modifying connectivity characteristics from a Harvard Business Review on driving digital transformation (Whitehurst, 2015) and suggestions operationalising connectivities (DasGupta, 2011; Sia et al., 2016) so they apply to Australian corporate CEO leadership to maximise usable responses. The

developed survey asks respondents to rate seven questions indicating disagreement or agreement) to their belief their leadership provides features indicated in the statement.

An example of item development is question number one, "As corporate leader, strategic human capital priorities I include are a collaborative digital culture to encourage knowledge sharing". As there are no existing measures for this connectivities construct, these measurement items are adapted (Dasgupta, 2011; Sia et al., 2016; Whitehurst, 2015) to measure extent to which leaders connect and collaborate their workforce to a digital future (Sia et al., 2016). Items are developed according to literature writing questionnaire items process (Korb, 2012). This item is adapted from "the greatest leadership challenge is how to make the workforce work collaboratively to create a culture allowing all voices of leadership to be heard" (DasGupta, 2011).

Further information on measurement item development can be found in Appendix C.

The survey items are displayed below.

As a corporate leader, strategic human capital priorities I include are;

1. A collaborative digital culture to encourage knowledge sharing.
2. Digital knowledge to enhance workforce collaboration.
3. Restructuring existing silos to nurture a collaborative digital culture.
4. Digital skills to improve business processing.
5. A digital servicing culture to engage our customers.
6. Digital culture and training to foster new ways of doing things.
7. Social network connectivities to broaden our communities reach.

3.5.4.3 Technologies

The technologies construct measures modifying technologies characteristics from a Harvard Business Review on driving digital transformation (Whitehurst, 2015) and suggestions operationalising technologies (DasGupta, 2011; Sia et al., 2016) so they apply to Australian corporate CEO leadership to maximise usable responses. The developed survey asks six questions.

An example of item development is question number one, "To enhance our strategic technical capabilities, I include smart technologies to integrate our operations". As there are no existing measures for this technologies construct, these measurement items are adapted (Dasgupta, 2011; Whitehurst, 2015) measuring extent to which leader's use emerging technologies to achieve his/her goals (Sia et al., 2016). Items are developed according to literature writing questionnaire items process (Korb, 2012). This item is

adapted from "It's time to leverage smart technologies as an integrated part of business strategy" (Whitehurst, 2015).

Further information on measurement item development can be found in Appendix C.

The survey items are exhibited below.

To enhance our strategic technical capabilities, I include;

1. Smart technologies to integrate our operations.
2. Intelligently connected digital ecosystems that further enable our business opportunities.
3. Corporate digital innovations to further transform our business.
4. Smart digital technologies that empower our workforce.
5. Digital global cloud connectivities.
6. Innovations to change our competitive landscape.

3.5.5 The Digital Transformation Construct

3.5.5.1 Digital Skills

The skills construct measures aspects of knowledge and skills application characteristics as they apply to a Harvard Business Review report on digital transformation (Whitehurst, 2015; Sia et al., 2016) so they apply to Australian corporate CEO leaders to maximise usable responses. The developed survey asks respondents to rate six questions, measuring a range of disagreement to agreement.

An example of item development is question number one, "As a Digital Leader into the future, I can demonstrate knowledge of digital infrastructure costs". As there are no existing measures for this technologies construct, these measurement items are adapted (Sia et al., 2016; Whitehurst, 2015) to measure extent to which CEOs can develop his/her talents and digital skills into the future (Whitehurst, 2015). Items are developed according to literature writing questionnaire items process (Korb, 2012). This item is adapted from "Leaders must learn and stay abreast of digital trends" (Whitehurst, 2015).

Further information on measurement item development can be found in Appendix C.

The survey items are displayed below.

As a Digital Leader into the future, I can;

1. Demonstrate knowledge of digital infrastructure costs.
2. Demonstrate knowledge of digital infrastructure and its use.

3. Apply technologies that identify, track, and mine our corporate data.
4. Implement effective corporate business technologies.
5. Build the strategic digital talents through my corporate.
6. Quickly upskill on how to use new and emerging technologies.

3.5.5.2 Digital Strategies

The strategies construct measures modifying strategies characteristics from the Harvard Business Review report of digital transformation (Whitehurst, 2015) and (DasGupta, 2011) so they apply to Australian corporate CEO leaders to maximise usable responses. The developed survey asks six questions.

An example of item development is question number one, "As a corporate leader, strategic financial priorities I include are digital platforms to transform business value chains into value networks". As there are no existing measures for this technologies construct, these measurement items are adapted (DasGupta, 2011; Whitehurst, 2015) to measure the extent to which leaders develop his/her digital corporate strategies from a financial priority's perspective (Whitehurst, 2015). Items are developed according to literature writing questionnaire items process (Korb, 2012). This item is adapted from "Digital business strategies have the ability to increase product and service delivery speeds" (Whitehurst, 2015).

Further information on measurement item development can be found in Appendix C.

The survey items are exhibited below.

As a corporate leader, strategic financial priorities I include are;

1. Digital platforms to transform business value chains into value networks.
2. Big data analytics capabilities.
3. Interconnected digital technologies platforms.
4. Future investment into digital operations.
5. Digital business transformations.
6. Building and communicating knowledge.

Structure of these construct measures is further supported by more recent literature (Columbus, 2018; Harvard Business Publishing, 2018; IDG, 2018) indicating current trending characteristics of high performing CEO leadership questionnaires.

Example questions from recent supportive literature include the following;

"Is digital-first business top of mind?" (Columbus, 2018)

"What does digital-business mean to you?" (IDG, 2018)

"Is leadership development driving results? Or missing the mark?" (HBP, 2018)

3.6 Response Rate & Data Collection Procedure

The self-administered on-line survey approach is considered a most appropriate method used widely in research (Mahotra, 2007). Main strengths of this method is providing anonymity, confidentiality and freedom of expression for respondents (Hair et al., 2010). This approach facilitates monitoring non-respondents, improves record keeping, and generates uniform data from diversity.

This approach minimizes costs compared with traditional methods of postage for survey distribution. However, like traditional research methods, on-line surveys have limitations. Considering limitations, this on-line survey is distributed using instant messaging on LinkedIn, which allows economical collection Australia wide.

Previous research suggests difficulty with motivating potential respondents to complete on-line surveys (Mahotra, 2007), may be overcome using engagement techniques in survey invitations to maximise response rate, reducing respondent's bias and increasing measurement validity (Dillman, 1991). Techniques include inclusive language and repeat reminders.

The survey link is shared as discussed above through LinkedIn messaging. A hyper-link is embedded in the invitation attaching to a cover letter in Survey Monkey initiating the survey. The cover letter emphasizes research is for academic purposes (PhD research and thesis) and participation anonymous, confidential and voluntary, with access to data limited to James Cook University research personnel only.

All connections are promised a Research Report regardless of participation. This step is important as anonymity is assured to all respondents.

3.7 Qualitative Data

Qualitative data is collected through the survey and contains information which cannot be measured quantitatively. This includes semi-structured interviews and open-ended questions. The aim of collecting qualitative data is to further support the Digital Leadership Research Model.

Two respondents provide semi-structured interviews without permission to record interviews, but with permission to transcribe responses. Duration of each interview is

approximately twenty minutes, and these interviews are analysed using thematic analysis (Evans, 2018).

Nine open-ended questions ask respondents opinions on three important factors a corporate leader should have in the digital age. These include three opinions each around three most important strategies capabilities, digital skills, and leadership attitudes.

The open-ended questions are analysed using NVivo 11 Plus software. Analysis includes building themes (nodes) assimilating quantitative Digital Leadership Research Model constructs.

This is important for providing structure to NVivo analysis, which generally lacks formal structure. From this added structure nodes are analysed with text enquiries or searches providing results such as word clouds, word trees, 3D cluster analysis, and directional project map.

These three open-ended questions are displayed below;

3.7.1 Leadership Attitudes

What are three most important leadership attitudes a corporate leader should have in the digital age?

3.7.2 Digital Skills

What are three most important digital skills a corporate leader should have in the digital age?

3.7.3 Strategies Capabilities

What are three most important strategies capabilities a corporate leader should have in the digital age?

3.8 Analysis of the Data

3.8.1 Construct Development & Reliability

Before testing the Digital Leadership Research Model, measurement construct reliability needs to be established. Construct reliability is extent to which a measurement tool measures concepts it intends measuring (Hair et al., 2010).

This research conducts exploratory factor analysis (EFA) first to establish measurement constructs internal consistency to determine if each observed construct (item) need to be kept or eliminated. Then Confirmatory Factor Analysis (CFA) is conducted to validate all construct measures of the Digital Leadership Research Model.

Next, the finally selected 165 cases are used to test propositions and construct measures put forward for the Digital Leadership Research Model. Using CFA with maximum likelihood and 200 oblim rotation, every measurement construct undergoes elimination for any cross-loads <0.30. Acceptable reliability must include KMO >0.60 and Barlett's $p<0.05$ for each construct, with residuals <0.05 (Cunningham, 2008).

Congeneric shape of each construct is internally checked, cross-checked and reduced sequentially item by item, averaging to its (final construct) single composite construct. Final construct measures with required validity and reliability are detailed in the following chapter four (See Table 4.7).

3.8.2 Model Testing

As structural equation modelling (SEM) is powerful quantitative data analysis, with techniques estimating and testing theoretical relationships among observed and latent constructs, it combines factor analysis and regression to handle multiple relationships (Hair et al., 2010). SEM uses path analysis methods to assess multiple relationships from EFA to CFA.

SEM has previously been used in research to examine predictive validity with authentic leadership (Walumbwa et al., 2008), to study transactional leadership with chronic stress (Rowold & Schlotz, 2009), and transformational leadership with job satisfaction (Omar & Hussin, 2013). Therefore, SEM is considered appropriate for testing the Digital Leadership Research Model. SEM tests the Digital Leadership Research Model through path model construction using both AMOS 25 and SPSS 25.

Displaying a set of constructs directionally influencing one another, path analysis consists of a group of models (Spaeth, 1975), which are related to multiple regression. Further, path analysis is considered a regression model extension, in which causal relationships are tested. Main purpose therefore, for using path analysis, is estimating significance and magnitude of proposed causal relationships between different sets of constructs using path diagrams.

Each model construct needs to go through regression analysis, regardless of whether constructs are independent or dependent in relation to other constructs. Reproduction of

the correlation matrix is achieved through the model, which is reproduced as a matrix determining goodness-of-fit, compared with observed correlation matrix.

AMOS 25 calculates various goodness-of-fit indicators, during path analysis (Arbuckle & Wothke, 1999). The proposed path analysis model contains Digital Leadership, digital imperatives, and digital transformation dimensional constructs.

The Digital Leadership Research Model is tested using SEM path analysis with parameter estimation for maximum likelihood method. This method simultaneously examines predicted multiple direct and indirect paths while providing global fit indices between data and theoretical model.

The proposed Digital Leadership Research Model includes the following constructs; authentic leadership, transactional leadership, transformational leadership, analytics, connectivities, technologies, skills, and strategies. (See Figure 2.4).

3.8.3 Indices Fit

Leadership and business literature identify use of three forms of SEM consistently. These are; (1) measurements model, (2) structural models and (3) combination of measurements and structure (McQuitty, 2004).

Using the combination approach for path model analysis in a single analysis, this research uses SEM for quantitative statistical modelling estimates, specifying and testing theoretical relationships among latent, observed endogenous and unobserved exogenous constructs (Byrne, 1994). SEM uses suites of CFAs combining covariance structure, factor and regression analysis.

With a specification linking model constructs assumed to build relationships affecting other constructs and directions (Kline, 2011), SEM approach is visually represented through theoretical propositions. SEM produces correlations, covariance, regression weights and variance in its estimation process and parameter estimates are converged through iterative procedures (Iacobucci, 2010; Schumacker & Lomax, 2004).

Indices of goodness-of-fit are produced through estimation process and evaluated checking the proposed model for fit to data; or whether modification is required to increase fit. Indices for fit are separated into three basics; (1) absolute, (2) comparative or incremental and (3) model parsimony.

Different fit indices have different rules about required minimum value for goodness-of-fit for each of the three basics (Arbuckle & Wothke, 1999; Byrne, 1994). Researchers

emphasize however, different fit indices may have problems. For example, Kenny and McCoach (2003) argue inconsistent standards of evaluation for acceptable models; and emphasize only chi-square (χ^2), CFI, TLI and RMSEA are common fit indices.

3.8.4 Chi-square

χ^2 assesses goodness-of-fit between sets of theoretically expected and observed values. It measures absolute discrepancy between matrices of implied covariance and variances of the matrix of empirical sample covariance and variances (Kenny & MCCoach, 2003). The model is considered as accepted if chi-square is not significant.

Sample size and model complexity are considered very sensitive (Kenny & McCoach, 2003). χ^2 tests show significantly different data than expected given a tested theory when sample size is large, even when difference is very slight or negligible or unimportant based on other criteria (Gulliksen & Tukey, 1958).

The associated degrees of freedom (DF) is an alternative measure, which some researchers refer to as normed χ^2 or relative chi-squared. Relative chi-square is the χ^2 per degree of freedom and model parsimony index (McQuitty, 2004).

Less sensitive to sample size, relative chi-squared is accordingly valued at χ^2 normed >1 and <2, thus indicating a very good model fit (Byrne, 1994; Hair et al., 2010). The accepted criterion is different across different researchers, and ranges from <2 (Ullman, 2006) to <3 (Kline, 2011).

3.8.5 Root Mean Square Error Approximation (RMSEA)

χ^2 statistics reflect any discrepancy in observed covariance matrixes when derived from data predicted covariance by model. Sample size is critical on which both χ^2 and multivariate normality in data rely (Hu & Bentler, 1998). Therefore, RMSEA is reported, which is used to calculate estimated absolute average difference between model covariance estimates and observed covariance.

RMSEA values <0.05 indicates a close fit, while values <0.08 is considered acceptable (Browne & Cudeck, 1992; Hu & Bentler, 1998; Steiger, 1990). However, Vandenberg and Lance (2000) recommend RMSEA cut-off values of 0.10 are still acceptable.

3.8.6 Comparative Fit Index (CFI)

In this research CFI is calculated to provide measures indicating a better way for the theoretical model to fit data compared with a based constraining model with all constructs

uncorrelated with each other. CFI is robust and reliable statistic, more so than χ² for models with constructs indicating deviations caused by normality multivariate. A CFI value of >0.95 or above considered good fit (Hu & Bentler, 1998). A model with a CFI of >0.90 occasionally an accepted model (Bentler, 1990; Vandenberg & Lance, 2000).

3.8.7 Other Fit Indices

A combination of χ², CFI and TLI are reported fit measures to test proposed models moderating effects (Steenkamp, Batra & Alden, 2003); while CFI, IFI, RMSEA, RNI and TLI also report fit combination measures from previous research (Knight & Cavusgil, 2004). However, McQuitty (2004) suggest goodness-of-fit indices less sensitive to sample size, such as TLI (Marsh, Balla & McDonald, 1988); combination of CFI, IFI and TLI (Bentler, 1990); and combination CFI, RMSEA and TLI (Fan, Thompson & Wang, 1999).

However, some researchers say it's difficult to apply all fit indices, and this research therefore uses a set of goodness-of-fit indices which are commonly reported and used in literature (Bolen & Stine, 1992; Hair et al., 2010; Hulland et al., 1996; Marsh et al., 1988) to assess degree of overall fitness of this Digital Leadership Research Model.

Fit indices used in this research are AGFI, Bollen-Stine P, χ²/DF, CFI, GFI, RMR, RMSEA and TLI. These are displayed below in table 3.2.

Table 3.2. *Goodness-of-fit indices: assessing measurement & structural models*

Fit Indices	Description	Cut-offs (model fit)	Reference
χ^2	Indicates discrepancy between proposition model & data; tests null hypothesis estimates covariance-variance deviates from sample covariance-variance matrix due to sampling error.	p>0.05	Kenny & McCoach, (2003)
χ^2/DF	Chi-square test, sensitive sample size & only meaningful when considering degrees of freedom. Its value is divided by degrees of freedom.	2-1 or 3-1	Kline, (2011) Ullman, (2006)
RMSEA	How model fits population covariance matrix. Considers degrees of freedom.	<0.05 good fit; <0.08 acceptable fit.	Browne & Cudeck, (1992) Hu & Bentler, (1998) Steiger, (1990)
GFI	Squared residuals from prediction with actual data. Not adjusted for degrees of freedom.	>0.90	Byrne, (1994)
AGFI	GFI adjusts for degrees of freedom.	>0.90	Hu & Bentler, (1998)
TLI	Indicates model fit compared with a baseline model, normally null model adjusted for degrees of freedom (can take a value greater than one).	>0.90	Hu & Bentler, (1998)
CFI	Indicates how a model fits compared with baseline model, normally null model adjusted for degrees of freedom.	>0.90	Byrne, (1994) Hu & Bentler, (1998)
RMR	RMR is an index of amount by which covariance & variance estimate differ from observed covariance & variance.	Smaller better 0= perfect fit	Weaver & Wuensch, (2013)

3.9 Chapter Three Summary

Discussing research methodology, this chapter examines the process of measuring constructs. Also, examining measurement development used for model testing, through to discussion of fit indicators used for different measures and indices of goodness-of-fit. Measurement results with goodness-of-fit shall be detailed in the following chapter, four.

4.0 Chapter Four - Data Analysis & Results

4.1 Introduction

Presenting findings of analyzed data, this chapter details survey respondent's characteristics, data screening, SEM Digital Leadership Research Model assessment, structural model fit and qualitative analyses results. Also, the research questions and propositions are examined and answered using SEM path analysis and qualitative analysis.

4.2 Data Validation Process

4.2.1 Examining Data Entry and Missing Data

The data are imported to SPSS directly from Survey Monkey, cleansed and examined for missing data. This provides critical insight into data for analysis (Hair et al., 2010). Ensuring data accuracy and completeness, data entry is double checked, and each case verified. Further statistics such as descriptive, frequency distribution, mean and standard deviation are checked.

Survey outcome validation process indicates a total of 309 respondents, with 144 eliminated due to missing data. The final 165 surveys are reserved in the database (completion rate is 53.4%) to be examined for testing normality and outliers.

When cleansing data, it is noted the final 165 survey responses have less than 25% missing values and as such are imputed to replace such missing values (Dong & Peng, 2013). Missing values may occur when some respondents do not respond to certain survey questions (Cunningham, 2008).

Missing values when handled properly increase potential accuracy of data interpretation. Imputation of missing values can decrease amount of bias in the data – provided values missing at random (MAR). MAR is chosen when values missing are distributed within one or more sub-samples; this is more common than missing completely at random (MCAR).

This research uses Little's (1988) SPSS MCAR test to indicate missing data is not significant at the >.001. Little's SPSS MCAR test results are: χ^2 = 438.524, DF = 414, P = 0.195. Therefore, this data set is assumed to be MCAR. Hence, there are no data problems and no systematic missing values.

χ^2 and degrees of freedom shown in Little's MCAR test of significance at P = 0.195 indicate suitability of Likert measures for the SEM path analysis. To offer enough diversity to the

SEM path analysis, covariance and mean structure analysis requires data to be a continuous scale, such as 1-5 Likert scale with data displaying a multivariate normal distribution (Byrne, 2001).

4.3 Validate Data with Previous and Published Data

4.3.1 Respondent's Profile

Demographic profiles of the final 165 respondents are tabled, plotted and compared with published similar data (See Tables 4.1 to 4.5 and Figures 4.1 to 4.5) (AICD, 2018; Bryant, 2018; Chief Executive Women, 2018; Durkin, 2012; Durkin, 2018; PwC, 2017; Korn Ferry, 2017; Robert Half, 2017; Robert Half, 2018). These demographics are tabled below, table 4.1 to 4.5; and figures 4.1 to 4.5.

Table 4.1. *Respondent's positions held*

Position Held	Per cent
CEOs	87%
Board Members	9%
Senior Managers	4%

All respondents are treated as Australian corporate CEOs in the data, despite positions being CEOs (87%), Board Members (9%), senior leaders (8%). This is because Board Members generally have previously been CEOs before ascending to board positions (AICD, 2018; Bryant, 2018), and senior leaders are decision-makers like CEOs and are generally positioned in or alongside the c-suite (Frisch, 2011; Korn Ferry, 2017).

Table 4.2. *Gender of respondent's*

Gender	Per cent
Male	85%
Female	15%

Although table 4.2 indicates a disproportionate gender distribution, the female response in this research is higher than recent census suggesting only 7% of Australia's ASX200 CEOs are female (Chief Executive Women, 2018). With only 21 of these ASX200 corporates having achieved gender balance in their executive team; and more than half of

these corporates having no women on their executive team at all. Hence, respondents appear representative of Australian corporate CEO gender population.

Table 4.3. *Digital savviness of respondent's*

Digital Savvy	Per cent
Very high	21%
High	39%
Average	36%
Low	4%
Very low	0%

Table 4.3 indicates digital savviness of respondents, with 39% high, 36% average, 21% very high; 4% low; and 0% very low. Contrasting this, recruitment firm Robert Half's (2018) CEO Tracker reports only 6% of ASX200-listed CEOs have technologies background, with over 50% hold accounting and finance background (Durkin, 2018). The PwC (2017) Digital IQ Survey revealed Australian corporate CEOs are lower in digital savviness (40%) than peers across the Asia Pacific region (70%) and lower in digital savviness than global averages (61%).

Overall digital savviness of Australian companies is more than 15% lower than the global average (36%) compared with both Asia and global (53%) (PwC, 2017). Interestingly Australian corporate CEOs are almost always responsible for setting corporate digital strategy and this might be a possible explanation as to why companies are 15% lower digital savviness globally.

Table 4.4. *Age of respondent's*

Age	Per cent
< 30 – Millennials	1%
30-45 – Generation Y	22%
46-60 – Generation X	63%
Over 60 – Baby Boomers	14%

Most respondents (63%) in the 46-60 age group are on par with Korn Ferry global research (2017), which found average age of CEOs globally is 58. This is up on previous figures of Australian average CEOs being age 53 (Durkin, 2012).

Table 4.5. *Education levels of respondent's*

	Secondary	Degree	Post-Graduate	Other
CEOs	6%	26%	52%	3%
Board Member	2%	1%	5%	0%
Senior Manager	0%	1%	3%	0%

These education results are consistent with Robert Half (2018) research findings 56% of Australian corporate CEOs have a post-graduate education, this is up from 54% (Robert Half, 2017) last year's results. 3% of respondents without a degree is much less than Robert Half (2018) findings 15% of Australian corporate CEOs have no degree at all.

The following figures of Australian corporate CEO Demographics group CEOs, Board Members, and Senior Managers together as one group, Australian corporate CEOs.
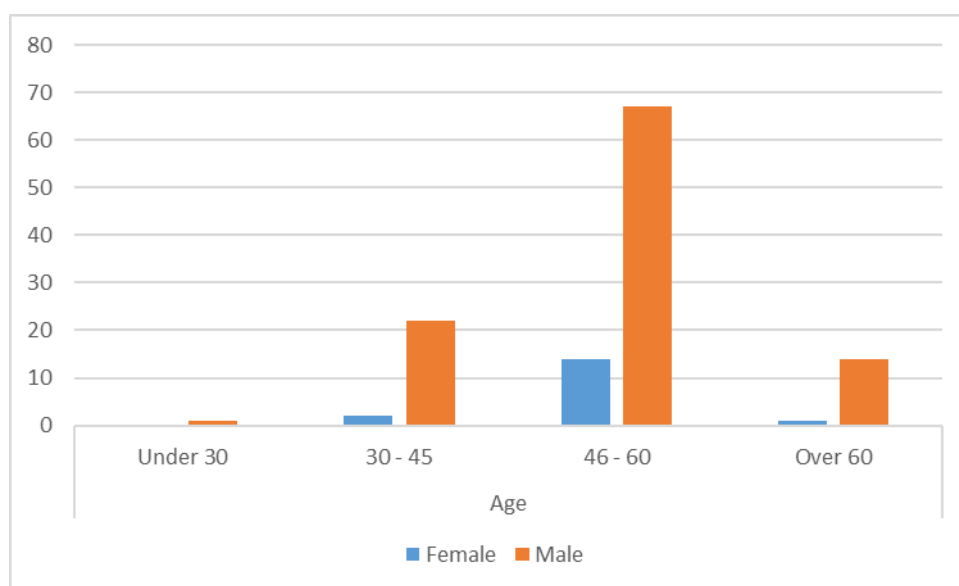
Figure 4.1. CEOs Age & Gender

Australian corporate CEOs age and gender are indicated above in figure 4.1. Interestingly most CEOs are in 46-60 years age group (generation X) indicating life experience is still considered valuable for Australian corporate leadership.
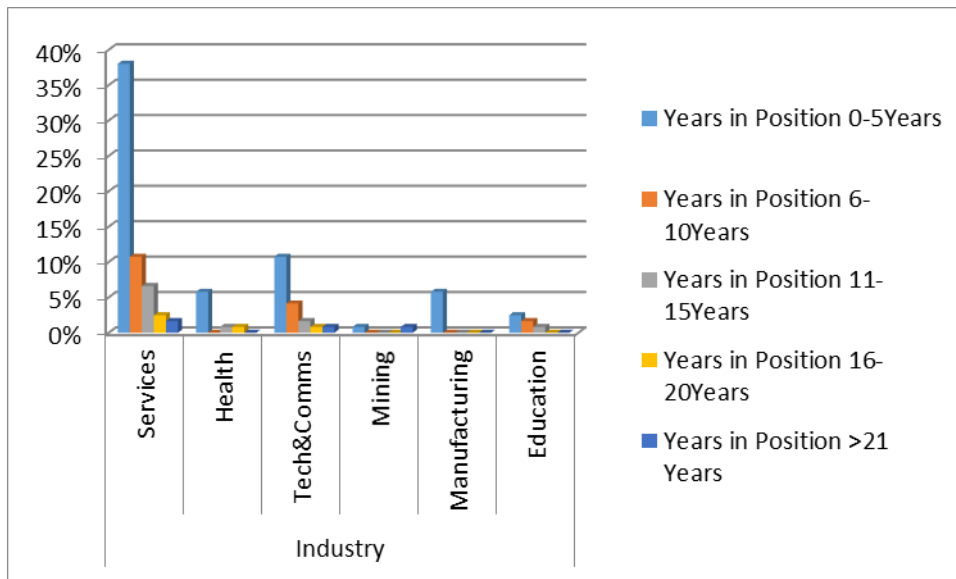
Figure 4.2. CEOs Years in Position and Industry

Most Australian corporate CEOs in this research work in services industries and have been in their position for 0-5 years. This result is consistent with Robert Half (2017) findings typically ASX200 CEOs (61%) are in their current role under 5 years; 26% in their position 6-10 years; and 13% are in their position for more than 11 years.
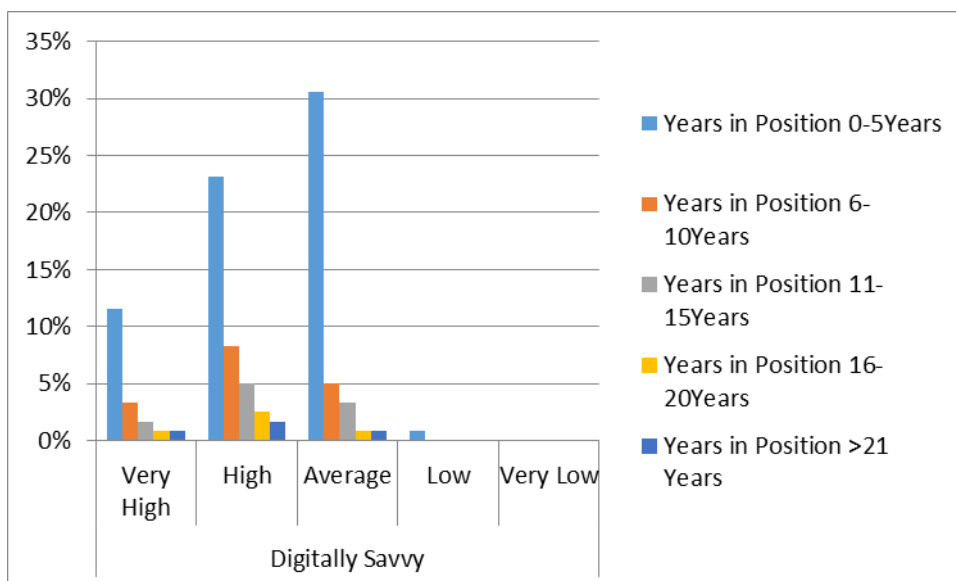
Figure 4.3. CEOs Years in Position and Digital Savviness

Australian corporate CEOs are mostly in their position 0-5 years and mostly average or high in digital savviness, providing support for the need for digital skills development (Harvard Business Publishing, 2018; Robert Half, 2017). Gartner (2018) recognize the need for CEOs to become more digitally savvy with 31% of surveyed CEOs mentioning their need to become more digitally savvy; and 41% indicating their corporate is digitally

innovative through savviness. However, these conflict with the PwC (2017) digital IQ survey which indicates Australian corporate CEOs are lower than Asian and global averages in digital savviness.
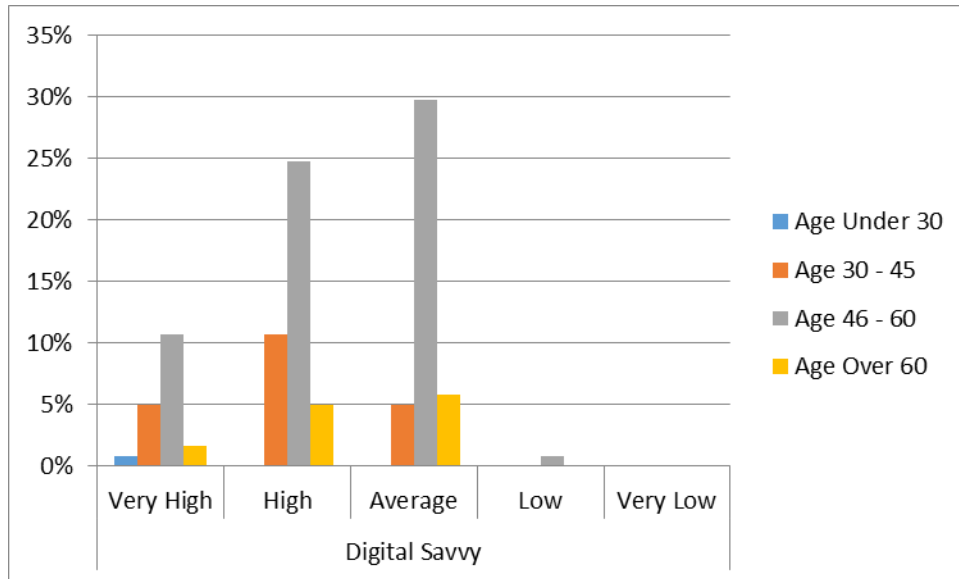
Figure 4.4. CEOs Age and Digital Savviness

Mostly Australian corporate CEOs are generation X, and mostly this age group is average or high in digital savviness. Interestingly, it is also generation X identifying low in digital savviness; with baby boomers also being mostly average or high in digital savviness; generation Y is mostly high, very high, or average in digital savviness; and millennials are very high in digital savviness (as would be expected, as the digital generation).
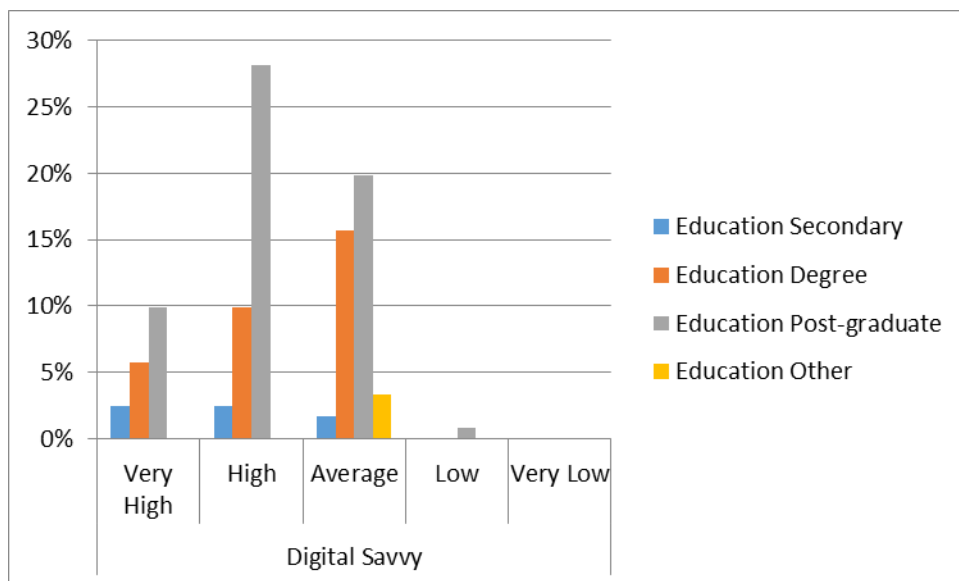
Figure 4.5. CEOs Education and Digital Savviness

Mostly Australian corporate CEOs with post-graduate education are high in digital savviness; those with a degree are mostly average in digital savviness; and those without a degree are all average in digital savviness.

Australian corporate CEOs level of digital savviness appears influenced by education level, and age, more so than years in position. As expected, millennials reported very high in digital savviness, and both generation X and Y are mainly high or very high in digital savviness; and post-graduates also high or very high.

Both gender and age group profiles exhibit similar trends to published research, indicating this survey data has high internal consistency and validity (Mooi, Sarstedt & Mooi-Reci, 2017). These factors indicate validity of this data for use in this research and for representing relative population of Australian corporate CEOs.

4.4 Normality & Outliers' Assessment

Data normality is a conventional assumption in estimation processes (Bai & Ng, 2005). High kurtosis and/or highly skewed data is indicative of non-normal data distribution (George & Mallery, 2016), and may indicate presence of outliers (Tabachnick & Fidell, 2013). Tabachnick and Fidell (2013) argue outliers with extreme values on one variable or construct (a univariate outlier) or combination of scores on two or more constructs (multivariate outlier), distort statistics.

The Digital Leadership Research Model constructs from chapter two and chapter three are assessed for normality and outliers. Normal distribution has a skewness of 0 and kurtosis within ±3 (Glass, Peckham & Sanders, 1972; Hair et al., 2010). Skewness and kurtosis are displayed below in table 4.6. These are under ±1 displaying high degrees of normality. However, normality plots are still examined and indicate near-normality (Hair et al., 2010).

Table 4.6. *Descriptive statistics*

Construct	Min	Max	Mean	St Dev	Kurtosis	Skewed
Authentic	1.00	5.00	4.11	0.54	-0.57	-0.04
Transactional	1.00	5.00	4.21	0.56	-0.13	-0.48
Transformational	1.00	5.00	4.10	0.57	1.03	-0.34
Analytics	1.00	5.00	3.60	0.75	0.21	-0.45
Connectivities	1.00	5.00	4.05	0.53	-0.15	-0.08
Technologies	1.00	5.00	4.03	0.59	0.68	-0.42
Skills	1.00	5.00	3.80	0.74	0.58	-0.63
Strategies	1.00	5.00	4.80	0.80	-0.12	-0.38

Valid N=165

The skewness of each construct is close to zero (0). With means above 3 and small standard deviations. This indicates respondents recognize and agree these constructs are important for considering digital transformation.

Additional methods are conducted to test for outliers (with extreme values unique to majority). These attempts identify multivariate and univariate outliers by evaluating Mahalanobis distance > χ^2 (8) = 24.67 (p < .001) (Tabachnick & Fidell, 2013). Statistical diagnostics reveal three cases with Mahalanobis distance greater than 24.67 (range: 26.23 to 35.52).

These cases are removed individually examining impact of each outlier on SEM path model. Removing each outlier has no significant impact on SEM path model, with only making minor changes to model beta (β) path weights and no significant difference to fit indices. Therefore, these outliers are retained for sample size purposes.

4.5 Results of Measuring Constructs

4.5.1 Digital Leadership Constructs

4.5.1.1 Digital Leadership - Authentic Leadership

Authentic leadership is examined initially with six items. Inspection of inter-item correlation matrices reveal three items poorly correlate (residuals >0.05) with other scale items. Therefore, factor reduction is used to delete these three items engage remaining three items (with residuals <0.05) to measure authentic leadership.

These have not affected construct face validity and summarization of final construct is below in table 4.7. Authentic leadership construct has mean 4.11, standard deviation 0.54 and Cronbach's alpha 0.65. This indicates high internal consistency (Hair et al., 2010).

4.5.1.2 Digital Leadership - Transactional Leadership

Transactional leadership is examined initially with six items. Inspection of inter-item correlation matrices reveals two items poorly correlate (residuals >0.05) with other scale items. Therefore, factor reduction is used to delete two items and engage remaining four items (with residuals <0.05) to measure transactional leadership.

These do not affect construct face validity, with final construct summarization below in table 4.7. The transactional leadership construct has mean 4.33, standard deviation 0.48 and Cronbach's alpha 0.60. This indicates high internal consistency (Hair et al., 2010).

4.5.1.3 Digital Leadership – Transformational Leadership

Examined initially with six items, transformation leadership has three items poorly correlated (residuals >0.05) compared with other scale items. Therefore, factor reduction is used to delete these three items and engage remaining three items (with residuals <0.05) to measure transformational leadership.

This does not affect construct face validity, with summarization of construct below in table 4.7. The transformational leadership construct has mean 4.06, standard deviation 0.57 and Cronbach's alpha 0.71. This indicates high internal consistency (Hair et al., 2010).

4.5.2 Digital Imperatives Constructs

4.5.2.1 Analytics

Analytics is examined initially with six items. Inspection of inter-item correlation matrix reveals one item poorly correlates (residuals >0.05) with other scale items. Therefore, factor reduction is used to delete this item and engage remaining five items (with residuals <0.05) to measure analytics.

This does not affect construct face validity, with summarization of the final construct below in table 4.7. The analytics construct has mean 3.61, standard deviation 0.75 and Cronbach's alpha 0.84. This indicates a high internal consistency (Hair et al., 2010).

4.5.2.2 Connectivities

Connectivities is examined initially with seven items. Inspection of inter-item correlation matrix reveals three items poorly correlate (residuals >0.05) with other scale items. Therefore, factor reduction is used to delete these three items and engage remaining four items (with residuals <0.05) to measure connectivities.

This does not affect construct face validity, with summarization of final construct below in table 4.7. The connectivities construct has mean 4.05, standard deviation 0.53 and Cronbach's alpha 0.76. This indicates high internal consistency (Hair et al., 2010).

4.5.2.3 Technologies

Technologies is examined initially with six items. Inspection of inter-item correlation matrix reveals no items poorly correlate (residuals >0.05) with other scale items. Therefore, factor reduction is not used to delete any items, with all six items retained to measure technologies. Final construct development is summarized in table 4.7.

The technologies construct has a mean of 4.04, a standard deviation of 0.55 and a Cronbach's alpha of 0.82. This indicates high internal consistency (Hair et al., 2010).

4.5.3 Digital Transformational Constructs

4.5.3.1 Digital Skills

Digital skills are examined initially with six items. Inspection of inter-item correlation matrix reveals two items poorly correlate (residuals >0.05) with other scale items. Therefore, factor reduction is used to delete these two items and engage remaining four items (with residuals <0.05) to measure digital skills.

This does not affect construct face validity, with summarization of final construct below in table 4.7. The digital skills construct has mean 3.77, standard deviation 0.74 and Cronbach's alpha 0.86. This indicates high internal consistency (Hair et al., 2010).

4.5.3.2 Digital Strategies

Digital strategies are examined initially with six items. Inspection of inter-item correlation matrix reveals one item poorly correlates (residuals >0.05) with other scale items. Therefore, factor reduction is used to delete this item and engage remaining five items (with residuals <0.05) to measure digital strategies.

This does not affect construct face validity, with summarization of final construct below in table 4.7. The digital strategies construct has mean 4.00, standard deviation 0.54 and Cronbach's alpha 0.87. This indicates high internal consistency (Hair et al., 2010).

In summary, all items load within acceptable range >0.50 and are considered significant (Hair et al., 2010). Further, Hair et al. (2010) suggests Cronbach's alpha above 0.60 are acceptable for exploratory research. All Cronbach's alphas of constructs in this research are presented below in table 4.7 and above recommended value of 0.60.

When examining construct validity using average variance extracted (AVE), all constructs but one is > 0.50 (Hair et al., 2010). Authentic leadership construct has an AVE < 0.50. However, Fornell and Larcker (1981) says if AVE is < 0.50 and composite reliability is > 0.60, then convergent validity of construct is still adequate.

It is necessary to retain these items to deliver the authentic leadership construct. Overall, internal consistency and reliability of constructs is strong and presented below in table 4.7.

Table 4.7. *Digital Leadership Research Model constructs*

References for Constructs	Item Q No.	Construct with Measurement Items	Item Loading	Mean	STD DEV (SD)	Cronbach Alpha (α)	Construct Load (SD*√α)	Construct Error (SD²*(1-α))	AVE
		Authentic Leadership	ML	4.11	0.54	0.65	0.44	0.10	0.39
Walumba et al. [2008]	Q16	Continually improve the preciseness of our corporate's information	0.78						
	Q17	Precisely convey corporate leadership perspectives to our workforce	0.78						
Whitehurst [2015]	Q18	Am focused on real-time solutions	0.75						
		Transactional Leadership		4.33	0.48	0.60	0.37	0.09	0.68
Northouse [2010]	Q12	Promote digital sales/marketing to expand our revenue growth	0.72						
Whitehurst [2015]	Q11	Allow our business to align and transact directly with our customers	0.68						
	Q9	Ensure my workforce is digitally savvy and flexible	0.66						
	Q10	Motivate my workforce towards benefiting our customers	0.66						
		Transformational Leadership		4.06	0.57	0.71	0.48	0.10	0.79
Northouse [2010]	Q3	Innovatively change our business processing systems	0.85						
Whitehurst [2015]	Q2	Always build smarter internal business communication systems	0.78						
	Q1	Reinvent our business processes	0.75						
		Analytics		3.61	0.75	0.84	0.69	0.09	0.71
Sia et al. [2016]	Q42	Data analytics to broaden our customer transactions	0.90						
Whitehurst [2015]	Q43	Data analytics to enhance our customer intelligences	0.84						
	Q41	Strategic roadmap to develop our big data analytics capabilities	0.70						
	Q38	Digital capabilities to monitor our competitors	0.55						
	Q39	Our real-time digital dashboard indicators to refine business prioritie	0.54						
		Connectivities		4.05	0.53	0.76	0.46	0.07	0.67
DasGupta [2011]	Q26	A collaborative digital culture to encourage knowledge sharing	0.75						
Sia et al. [2016]	Q25	Digital knowledge to enhance workforce collaboration	0.70						
Whitehurst [2015]	Q27	Restructuring existing silos to nurture a collaborate digital culture	0.62						
	Q28	Digital skills to improve business processing	0.60						
		Technologies		4.04	0.55	0.82	0.50	0.06	0.66
DasGupta [2011]	Q35	Smart technologies to integrate our operations	0.74						
	Q34	Intelligently connected digital ecosystems that further enable our business opportunities	0.74						
Sia et al. [2016]	Q36	Corporate digital innovations to further transform our business	0.74						
Whitehurst [2015]	Q33	Smart digital technologies that empower our workforce	0.63						
	Q32	Digital global cloud connectivities	0.57						
	Q37	Innovations to change our competitive landscape	0.52						
		Digital Skills		3.77	0.74	0.86	0.69	0.08	0.78
Sia et al. [2016]	Q72	Demonstrate knowledge of digital infrastructure costs	0.91						
Whitehurst [2015]	Q73	Demonstrate knowledge of digital infrastructure and its use	0.90						
	Q69	Apply technologies that identify, track, and mine our corporate data	0.65						
	Q74	Implement effective corporate business technologies	0.64						
		Digital Strategies		4.00	0.70	0.87	0.65	0.07	0.76
DasGupta [2011]	Q24	Digital platforms to transform business value chains into value netw	0.78						
Whitehurst [2015]	Q22	Big data analytics capabilities	0.78						
	Q21	Interconnected digital technologies platforms	0.76						
	Q23	Future investment into digital operations	0.74						
	Q20	Digital business transformations	0.74						

4.6 Overall SEM Digital Leadership Research Model Fit

The SEM Digital Leadership Research Model indicates all existing paths significant at least p <0.05, with greatest significance p <0.000. Further, no extra or redundant paths remain in the model (all remaining MI's <4.0). This study's Digital Leadership Research Model indicates consistent excellent fit across all SEM goodness-of-fit measures, which is encouraging considering the smallish data set. The fit measures discussed below in table 4.8 indicate specific test fit with small data sets (Hair et al., 2010).

Table 4.8. *Goodness-of-Fit measures for SEM path model*

	X^2/DF	RMSEA	CFI	RMR	GFI	Bollen-Stine P	TLI	AGFI
	2.28	0.08	0.97	0.02	0.97	0.43	0.92	0.90
Actual Good Fit	2-1 or 3-1	<0.05 good fit; <0.08 reasonable fit	>0.90	<0.05	>0.90	>0.05	>0.90	>0.90
Reference	Kline [2011] Ullman [2006]	Browne & Cudeck [1992] Hu & Bentler [1998] Steiger [1990]	Byrne [1994] Hu & Bentler [1998]	Tabachnick & Fidell [2012]	Byrne [1994]	Bollen & Stine [1992]	Hu & Bentler [1998]	Hu & Bentler [1998]

The normed Chi-square (χ^2 /DF = 2.28, P (Bollen-Stine) = 0.43) indicates an excellent model fit exists (Cunningham, 2008; Schumacker & Lomax, 2004). CFI, GFI, TLI, and AGFI values are all above 0.90, which again suggests an excellent fit model (Bentler, 1990; Cunningham, 2008; Hair et a., 2010). Both RMSEA and RMR are below their threshold values and therefore support an excellent fit model (Hair et al., 2010).

Thus overall, all measures across the Digital Leadership Research Model deliver an excellent fit. This indicates a valid path model exists between this study's constructs and propositions.

4.7 SEM Digital Leadership Research Model

This section assesses propositions for testing the Digital Leadership Research Model.

4.7.1 Path Modelling

The resultant SEM Digital Leadership Research Model path model developed from figure 2.4 is presented in this chapter as figure 4.6. It indicates existence of eight significant pathways from Digital Leadership to digital imperatives (p<0.05).

These pathways partially support proposed literature-developed proposition 1. Each pathway shows standardized regression coefficient beta weights (with p-level significance) (See Figure 4.6).

Further, this SEM path model indicates existence of seven significant pathways from digital imperatives to digital transformation (p<0.05). These pathways fully support proposed

literature-developed proposition 2 and are displayed with their standardized regression coefficient beta weights (with p-level significance) (See Figure 4.6).
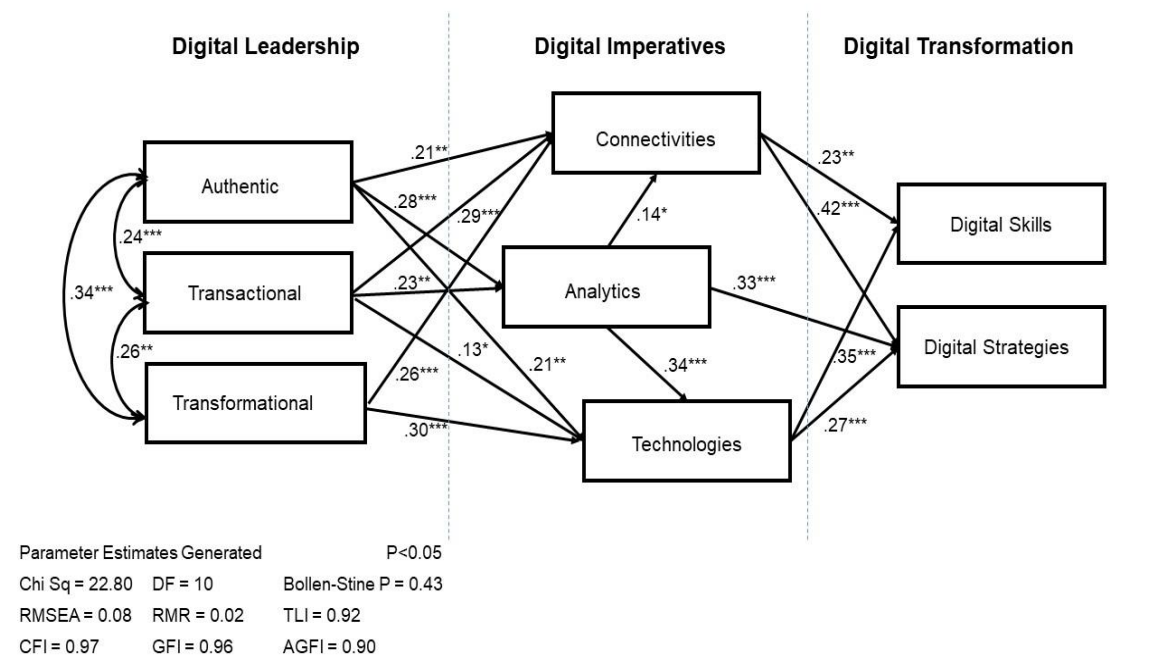
Figure 4.6. SEM Path Model, Digital Leadership Research Model (Standardized Estimates)

SEM path analysis delivers estimated coefficients, standard errors and calculated t values for all constructs in the model. Each estimate coefficient tests for statistical significance for hypothesized causal relationships (propositions) when significance level is deemed appropriate. Traditionally this is 0.05 (Hair et al., 2006).

The standardized beta (β) coefficients in SEM have equal variances with a maximum value of 1.0, thus approximating effect sizes. Beta (β) coefficients near zero have little effect, whereas increasing β values correspond to increased importance of each causal relationship (Cunningham, 2008). This SEM path model has an excellent fit and is validated via bootstrapping (x200), which converges quickly within 114 samples of this data.

The SEM Digital Leadership Research Model indicates; (1) Digital Leadership influences digital imperatives with each leadership approach using different pathways (digital imperatives) to digital transformation and (2) digital imperatives predicts digital transformation with strongest direct influence of digital strategies being connectivities, and strongest direct influence of digital skills being technologies.

Covariance between the three leadership approaches provides support an overlap exists between the three leadership approaches. The leadership approach which strongly uses analytics is authentic leadership, the leadership approach which strongly uses connectivities is transactional leadership and the leadership approach which strongly uses technologies is transformational leadership.

The SEM path model also indicates an interesting approach to how analytics drives both digital strategies and digital skills. Analytics drives digital strategies both directly and indirectly through a step-wise approach using either connectivities or technologies and again analytics drives digital skills through an indirect approach through either connectivities or technologies.

However, standardized total effects from SEM path analysis reveal most effective and efficient leadership approaches for predicting digital skills are authentic and transformational leadership (both 17%); and the most effective and efficient leadership approach for predicting digital strategies is authentic leadership (28%), followed closely by transactional leadership (27%).

All SEM paths are positive and uni-directional. This suggests digital transformation is causal, mostly influenced by Australian corporate CEOs when using a combination of leadership approaches through available digital imperatives.

This thesis provides a good take-up point from which additional Digital Leadership Models and additional digitally related construct developments may arise. In terms of using a combination leadership approach in a Digital Leadership Research Model, today's Australian corporate CEOs may enhance and develop their high performing corporate by adopting a combination of digital imperatives approach to positively and directionally-focus towards generating greater digital transformation strategies; and towards driving digital skills recruitment and development.

This Digital Leadership approach is likely well-suited for Australian corporate CEOs and this Digital Leadership approach may increase their digital IQ when leading within today's digital age corporate business world.

4.7.2 Proposition Testing

Authentic and transformational leadership are found to share significant covariance $p<0.000$, indicating significant overlap (Avolio & Gardner, 2005). Both authentic and transactional leadership relationship and transactional and transformational leadership

relationship also share significant covariance at p<0.01, further indicating some overlap exists (Hoch et al., 2018).

These significant covariance results provide support for three leadership approaches being used in a combination leadership approach (Gunzel-Jensen et al., 2018; Vitale, 2017; Zhu et al., In Press) (See Figure 2.1).

Although the direct pathways of technologies and connectivities appear to predict digital skills and digital strategies. The strongest influence of both digital skills and digital strategies is through indirect approach linking analytics to technologies to drive digital skills (p<0.000) and linking analytics to technologies to drive digital strategies (p<0.000).

Table 4.9. *SEM Output for proposition pathways, (See Figure 2.4)*

Proposition	Path	β	SE	CR (t)	SEM Results
Proposition 1					
Digital leadership influences digital imperatives					
Authentic leadership influences analytics	Authentic>>analytics	0.28***	0.10	3.74	Supported
Authentic leadership influences connectivities	Authentic>>connectivities	0.21***	0.07	3.06	Supported
Authentic leadership influences technologies	Authentic>>technologies	0.21***	0.07	3.27	Supported
Transactional leadership influences analytics	Transactional>>analytics	0.23**	0.10	3.09	Supported
Transactional leadership influences connectivities	Transactional>>connectivities	0.29***	0.06	4.46	Supported
Transactional leadership influences technologies	Transactional>>technologies	0.13*	0.06	2.12	Supported
Transformational leadership influences analytics	Transformational>>analytics	-	-		Not supported
Transformational leadership influences connectivites	Transformational>>connectivites	0.26***	0.06	3.96	Supported
Transformational leadership influences technologies	Transformational>>technologies	0.30***	0.06	4.79	Supported
Proposition 2					
Digital imperatives influence digital transformation					
Analytics influence skills	Analytics>>skills	-			Not supported
	Analytics>>connectivities>>>skills	0.37	0.05	5.25	Supported
	Analytics>>technologies>>>skills	0.69	0.05	10.18	Supported
Analytics influence strategies	Analytics>>strategies	0.33***	0.06	5.82	Supported
	Analytics>>connectivities>>>strategies	0.56	-	10.07	Supported
	Analytics>>technologies>>>strategies	0.61	-	10.02	Supported
Connectivities influence skills	Connectivities>>skills	0.23**	0.10	3.09	Supported
Connectivities influence strategies	Connectivities>>strategies	0.42**	0.08	7.91	Supported
Technologies influence skills	Technologies>>skills	0.35***	0.09	4.79	Supported
Technologies influence strategies	Technologies>>strategies	0.27***	0.08	4.63	Supported

4.8 Qualitative Results

Qualitative data collected simultaneously with quantitative data collection, and two semi-structured interviews are conducted during data collection period are presented in this section. Semi-structured interviews are used to capture relevant emerging themes (Longhurst, 2003). Nine open ended questions are designed to support the Digital Leadership Research Model (See Figure 2.4).

The open-ended questions ask respondents three opinions on each of these three questions, "what are three most important (digital skills, strategies capabilities, and leadership attitudes) a corporate leader should have in the digital age?".

4.8.1 Respondent Interviews

4.8.1.1 Interview A: The Australian Federal Government

This respondent did not give permission for recording. These comments emerged from notes taken. At interview end, notes are read back to respondent for accuracy and confirmation.

"… the current wave of information technology driven change is led by people with no relevant knowledge."

This interview with a senior Australian corporate leader provides the Federal Government's perspective of wanting to transform digitally but of hiring people with no idea of how to make digital transformation happen. The perspective given indicates the Digital Transformation Agency demonstrates transformation in name only, and those within the Agency held neither relevant skills nor suitable foundational knowledge of digital transformation.

This interviewee strongly suggested a new style of leadership may be required to lead through the digital age. One who is more digitally attuned, rather than focused on procurement policy, control of cash flows, and on establishing a government identity control system.

Comments include following;

"… corporate and public sector culture have recognizable similarities. Here, over many years, we have seen the rise of the unqualified. It's politely called the 'generalist' leader, able to move nimbly from one area of knowledge to another, equally ignorant of them all."

"…the word transformation appears only in the name of the Digital Transformation Agency, and not in any of the list of duties required. That list is focused strongly upon procurement policy and control of cash flows."

"The misnaming of the Agency has been very effective at shielding important facts concerning digital transformation here in Canberra. From the perspective of the Commonwealth of Australia, digital transformation has effectively stopped."

Hence this Australian corporate leader indicates there remains much for Australian Government to learn in developing and acquiring digital skills and digital strategies required for delivering a digitally transformed government. This interview provides support a strong corporate Digital Leadership is a necessity for delivering digital transformation in government. Hence, this supports propositions of the Digital Leadership Research Model.

4.8.1.2 Interview B: Head of Motor Vehicle Repairers Membership Association

This respondent did not give permission for this semi-structured interview to be recorded. Thus, these comments emerged from researchers notes. At interview end, notes are read back to respondent for accuracy and confirmation.

"… technology is changing motor vehicles, but repairers aren't ready for the technology"

This Australian corporate leader is head of a motor vehicle repairer's membership association – consisting of around 20,000 members. This association represents interests of motor repairers, panel beaters, and spray painters.

The perspective provided suggests career advisers need to do more to attract skilled people to this highly technical field. As today's motor vehicles are changing rapidly, industries with capabilities across autonomous driving, vehicle sensor technologies and vehicle digital calibration repairers are now needed; and these technically skilled persons also need continual ongoing training to keep up with the latest emergent technologies.

"We need to attract more Generation Y's and Z's to this high technology industry."

Again, this clearly indicates Australian corporate CEOs are recognizing digital imperatives are important drivers for delivering an ongoing and refreshed digital skills and digital strategy (Kiron, et al., 2016). This interview also supports propositions of the Digital Leadership Research Model.

4.8.2 Nine Open-Ended Questions

The on-line survey asks nine open-ended questions to learn about leadership attitudes, digital skills and strategic capabilities of Australian corporate CEOs. These data are analyzed for frequency statistics (Excel) with results displayed in pie charts (See Figures 4.7 to 4.9); and text frequency queries (NVivo 11 Plus software). NVivo results provide interesting coding analyses such as word cloud, word trees (See Figures 4.10 to 4.12), 3D cluster analyses (See Figures 4.13 – 4.18) and directional project map (See Figure 4.19).

4.8.2.1 Leadership Attitudes

This open-ended question asked Australian corporate CEOs, "What are three most important leadership attitudes a corporate leader should have in the digital age?".

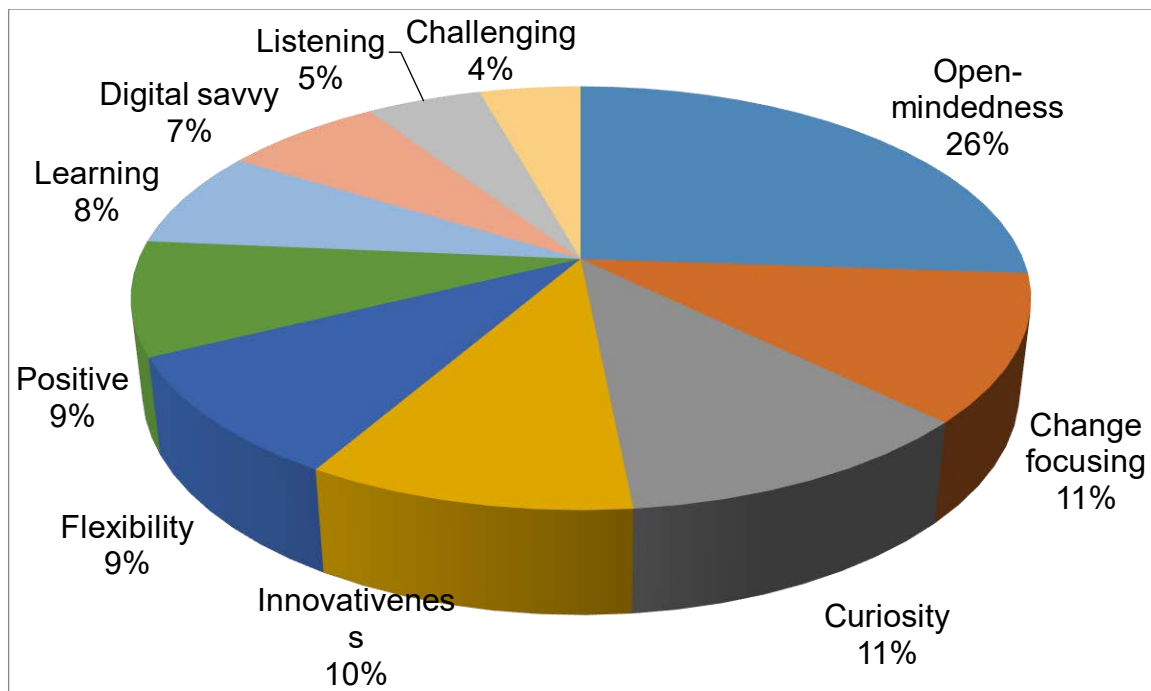Results are displayed below in figure 4.7.

Figure 4.7. The Most Important Leadership Attitudes in the Digital Age

Top five results include; open-mindedness (26%), change focusing (11%), curiosity (11%), innovativeness (10%), and flexibility (9%). Interestingly, the top four attitudes can be explained within three leadership approaches in this research.

Strength of Australian corporate CEOs attitudes in the digital age possibly stem from how each CEO integrates attitudes collectively towards transforming their corporate then, how attitudes deliver digital transformation solutions. This implies a broad digital strategic approach is generally required by today's CEOs, which likely is not just a singular focus on transformation through technology components.

As Digital Leaders focus more on digital transformation (change focus), ultimate power of overall attitude lies in their power to scope and deploy objectives (curiosity and innovativeness). A CEO who only focuses on today's digital technologies alone provides little inherent corporate advantage, unless they engage attitude required to understand and wisely deploy such technologies (such as open-mindedness).

Fitzgerald et al. (2014) suggests Digital Leaders who strategize and don't adopt digital transformation options are those most likely to fall behind in both competitiveness and in corporate learning. Thus, Australian corporate CEOs should focus on technologies being more than end solutions, but also strategically portray ongoing successful digital transformational solutions.

Improving curiosity and innovation remain strategic objectives, with Kane et al. (2015) finding 90% of digital strategies in digitally mature organizations, focus on improving innovation. Further they suggest CEOs really understand digital technologies power (Kane et al., 2015). "This is as much of a transformational story as it is a technology one" adds Carlos Dominguez, president & COO of Sprinklr, and social technology provider (Kane et al., 2015).

Hence, while technology and digital transformation should be inherently interconnected, so should digital skills development and leader's embedded attitude which is part of the engaged leadership approach (Avolio & Gardner, 2005).

4.8.2.2 Digital Skills

The next open-ended question asked Australian corporate CEOs "What are three most important digital skills a corporate leader should have in the digital age?".

Results are displayed below in figure 4.8.

Top five results include communication (23%), digital savviness (14%), leadership (11%), analytics (9%), and listening (8%). Interestingly communication is the top result aligning with connectivities construct. Top four results include this research's three digital imperatives (analytics, connectivities, and technologies) digital skills, supporting the connection between digital imperatives and digital transformation with regards to analytics, connectivities, technologies, and leadership.

When developing digital skills, Australian corporate CEOs may want to consider future possibilities, then work backwards. This approach is comparable to visioning an online buy-sell world, then reverse engineering to devise a full e-business and e-commerce digital solution, then stimulating demand through frenzied social media solutions (Chen & Chang, 2003; Funk, 2012; Armstrong et al., 2015).

Digitally mature corporates don't tolerate digital skills gaps, and therefore may see ability to build necessary digital skills encourages capitalization of digital trends (Fitzgerald et al., 2014). Only 21% of respondents express digital skills need for; collaboration, vision, decision making and team building. These four digital skills may be bolstered as desired.
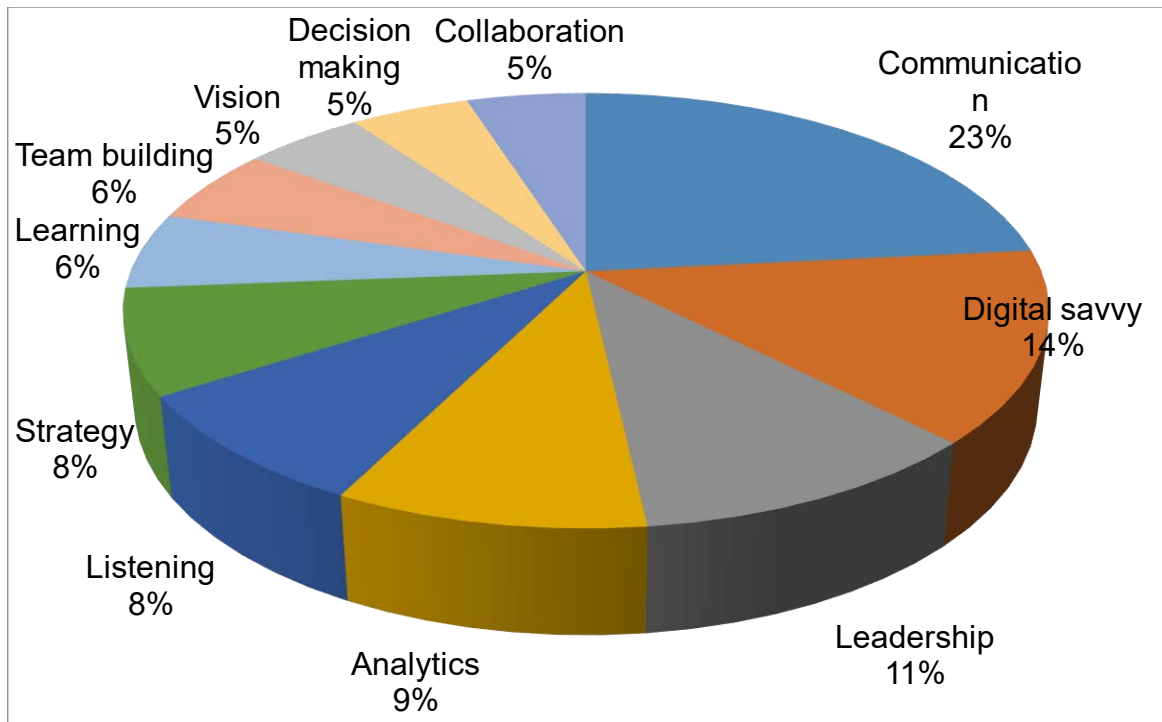
Figure 4.8. The Most Important Digital Skills in the Digital Age

However, digital innovation skills and strategic initiatives may also arise through collaborative corporate efforts, drawing on cross-functional teams across diverse backgrounds (Majchrzak et al., 2012). However, Australian corporate CEOs rate strategy low (8%) in relation to other digital skills.

This analysis indicates many Australian corporate CEOs are recognizing importance of communication, digital savviness, leadership and analysis as key drivers when considering digital transformation. However, some CEOs also recognize their corporate is not yet ready to implement their desired digital transformation.

4.8.2.3 Strategies Capabilities

The next open-ended question asked Australian corporate CEOs "What are three most important strategic capabilities a corporate leader should have in the digital age?".

Results are displayed below in figure 4.9.

Results include these top five; digital savviness (22%), strategic thinking (12%), communication (10%), customer focus (8%), change management (8%), and flexibility (7%).

Interestingly, top strategy capability digital savviness (22%) is far lower than survey demographics results which indicate 60% of Australian corporate CEOs consider they are

high or very high in digital savviness. Thus, providing support for importance of digital savviness for charting digital strategy.
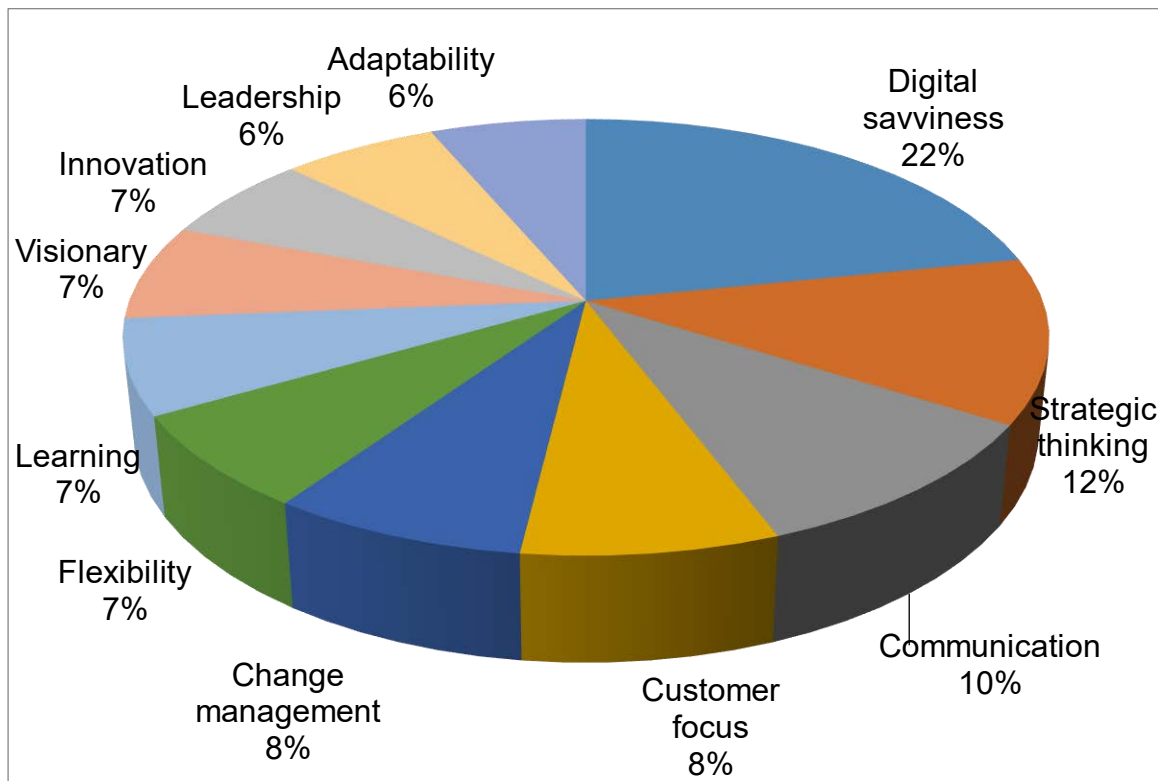
Figure 4.9. The Most Important Strategic Capabilities in the Digital Age

Figure 4.9 strategies capabilities split into two main groups; (1) top four strategic areas (digital savviness, strategic thinking, communication, & customer focus) and (2) following seven areas associated with organizational change and learning in the digital age. These areas indicate these Australian corporate CEOs recognize importance of these strategic capabilities areas and are aware these enablers should be considered when developing digital transformational strategies.

In summary the strategy capabilities areas shown in figure 4.9 may also be viewed as digital strategies required for digital transformation. While digital skills apply to operational abilities for applying perceived digital imperatives. Hence, this provides some support for the Digital Leadership Research Model.

4.8.3 Qualitative Content Analysis

Australian corporate CEOs opinions are captured as data and entered in NVivo 11 Plus. Here, data is analyzed, explored and used to display content of opinions. Initial NVivo project is given the title 'Leadership in the Digital Age'.

Data are imported into NVivo project from Excel spreadsheets where it is analyzed for frequencies and displayed as figures 4.7 to 4.9. Next data is sorted and coded into eight themes (nodes) corresponding with Digital Leadership Research Model (See Figure 2.4), and SEM path model constructs (See Figure 4.6).

These eight constructs are coded as child nodes and grouped under 'parent' nodes corresponding with Digital Leadership, digital imperatives and digital transformation. Once data is coded, data is analyzed using text coding queries.

The first text query analyzes frequency of coded words and summarizes them in a word cloud (See Figure 4.10). Further analysis of two most frequently used words are then developed into word trees (See Figure 4.11 & Figure 4.12) to understand frequently used phrases associated with most frequently used words.

The word cloud visually displays frequency of coded words. Words appearing larger than other words in the word cloud are more frequently used. Similarly, the word tree displays frequently used words and phrases around analyzed most frequently used word.

Further analysis is conducted on data to understand a 3D approach to construct correlations, and finally a directional project map provides a visualization of how nodes relate to one another assimilating Digital Leadership Research Model path model.

4.8.3.1 The Word Cloud

This word cloud (See Figure 4.10) displays most frequently used words from the open-ended questions, indicating differences in word sizes. The word 'digital' appears as the largest word in the cloud and therefore most frequently used word. This is followed by other large words such as 'open', 'change', and 'communication' indicating frequency of use.

The smaller the word in the cloud the less frequently they appear in data. Interestingly, this indicates words which are not 'top-of-mind' for Australian corporate CEOs.

These smaller words include 'skills', 'strategic' and 'leadership'; and a really small word, 'transformation' indicates Australian corporate CEOs are not really considering transformation at all. Also, interesting, other themes these CEOs are not thinking about include 'capabilities', 'teams', 'knowledge', and 'management'.

This indicates a possible gap in thinking. Although Australian corporate CEOs say they are high or very high (60%) in digital savviness, and this evidenced by the most frequently used word 'digital', they are not considering transformation a priority.

Figure 4.10. Word Cloud of Leadership Attitudes, Digital Skills, and Strategic Capabilities.

In summary, the word cloud portrays Australian corporate CEOs perceived digital transformation strategies. Australian corporate CEOs associate the word 'digital' with engagement and actions. They relate digital to openness, change, and communications as top agenda with their desired digital strategies. They are thinking in terms of digital and digitally related issues but are not ready for transformation.

Thus, revealing a possible gap, may be addressed through the Digital Leadership Research Model. This word cloud indicates there are multiple pathways by which an Australian corporate CEO can achieve desired digital transformation. These suggest different corporates may adopt different pathways to achieve their desired digital transformations. This is in-line with propositions proposed for the Digital Leadership Research Model.

Like the word cloud approach, text queries on most frequently used words 'digital' and 'open' displays word trees. These word trees display phrases used around the text queried word. This researcher examines words 'digital' and 'open'. Again, larger words and phrases in the word tree have been used more frequently.

4.8.3.2 The Word Tree

The word tree is developed by selecting a word in the word cloud and exploring it for phrases based on frequency of use. The 'digital' word tree (See Figure 4.11) develops

understanding of ways 'digital' is used in phrases captured from Australian corporate CEOs and helps to understand their thinking.

Digital appears at the center of the word tree. To the left of 'digital' are words and phrases influencing and connected into the word 'digital', and to the right are the words and phrases outcomes associated with the word 'digital'.

Examples include popular phrases such as "digital transformation enable operational innovation"; and "willingness to hire Digital Leaders"; and "Digital Leaders seek technology enabled opportunity to expand"; and "knowledge of how to hire Digital Leaders"; and, phrases associated with "Digital Leaders" are popular themes. These examples demonstrate think around digital strategies and digital skills.

A second word tree examines second most frequently used word from the cloud word, and this is 'open' (See Figure 4.12). Figure 4.12 demonstrates popular phrases such as having an "open mind" and "to be open to change and new possibilities" considered by Australian corporate CEOs.

These word trees indicate multiple priority pathways by which an Australian corporate CEOs can achieve desired digital transformation. These suggest different CEOs may adopt different pathways focusing around digital solutions in different ways.

The word tree shows multiple pathways through which Australian corporate CEOs can engage to achieve a desired digital transformation. It also shows CEOs likely prioritize their corporates' digital transformation differently as they interact in their industry and global markets.

The word tree 'digital' (See Figure 4.11) indicates some Australian corporate CEOs may use "technologies to improve performance and customer interaction". These CEOs adopt an external corporate focus when pursuing their digital transformation. Other CEOs may look to "transformation to enable their operational innovation', such CEOs have an internal focus when pursuing digital transformation.

Hence, different Australian corporate CEOs frame digital perspectives differently, yet each believes they are digitally savvy, and delivering desired digital transformation. This also suggests Australian corporate CEOs have multiple pathways through which their can deliver digital outcomes. This finding further provides support for multiple transition pathways and offers support for the Digital Leadership Research Model.
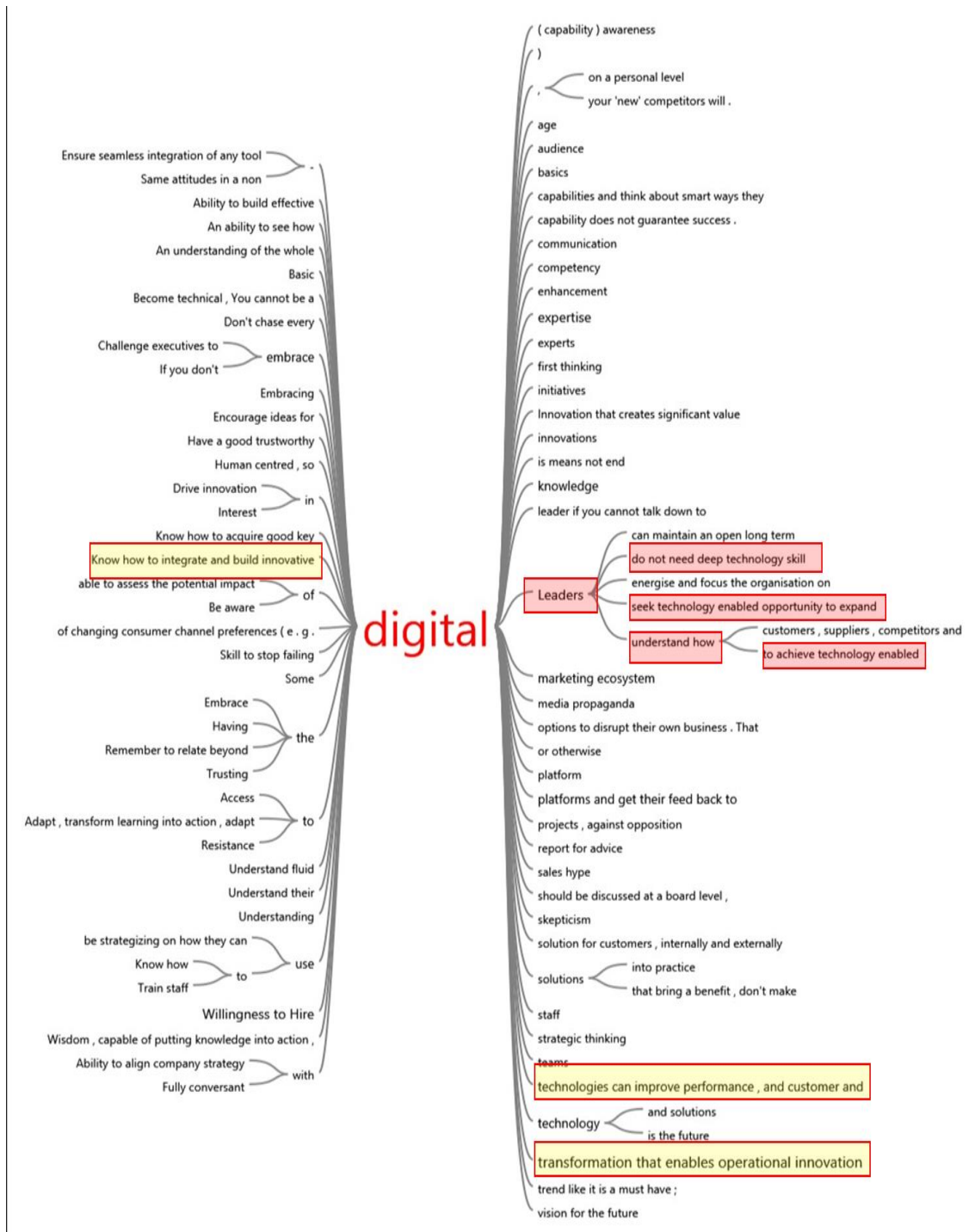
Figure 4.11. Word Tree Text Search Based on the Word 'Digital'

Below, figure 4.12 provides another word tree example using second frequently used word from the word cloud, 'open'. 'Open-mindedness' as indicated in figure 4.7 is the most important leadership attitude in the digital age. The different degree of 'open' (on right-side of word tree) perceived by Australian corporate CEOs may constitute different leadership approaches. This suggests and supports claims Digital Leadership may be combination of leadership approaches.
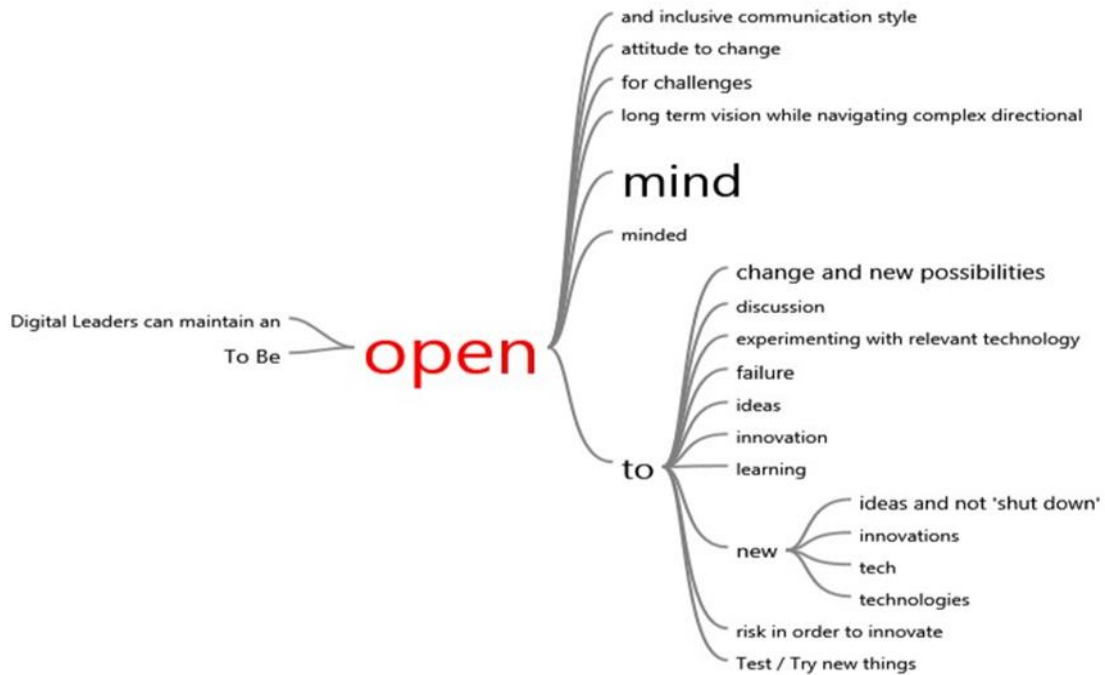
Figure 4.12. Word Tree Word Text Search Based on the Word 'Open'

4.8.3.3 Cluster Analysis

Further qualitative analysis includes 3D cluster analysis. Nodes are analyzed by coding similarity and measured with Pearson's correlation coefficient. This means nodes may be grouped according to correlations between child nodes and/or parent nodes.

The cluster analysis generates a 3D display of clusters of nodes according to aggregates of data coding illustrating how each node positions in correlation to each other. Using three leadership nodes, authentic, transactional, and transformational and parent node Digital Leadership, the first 3D cluster map is displayed below in figure 4.13.

To investigate possible leadership overlaps this research rotates the 3D cluster map positioning authentic leadership to the right, transformational to the left, transactional to the center top position, and Digital Leadership positions in the lower front section of the map. This 3D cluster map provides some support for a combination leadership approach. This is displayed in figures 4.13 and 4.14
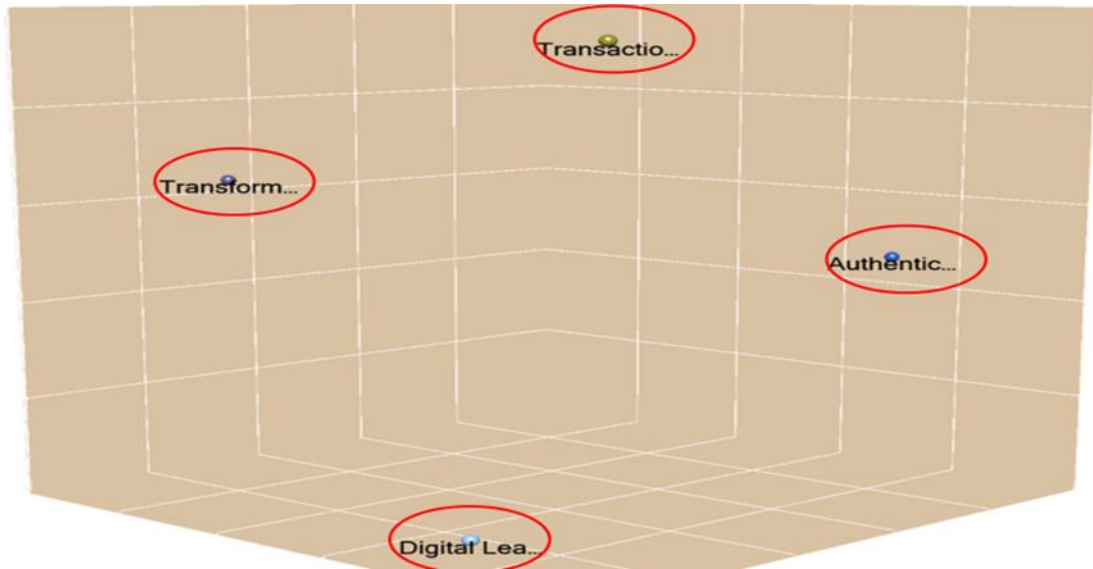
Figure 4.13: 3D Cluster Analysis of Leadership Approaches
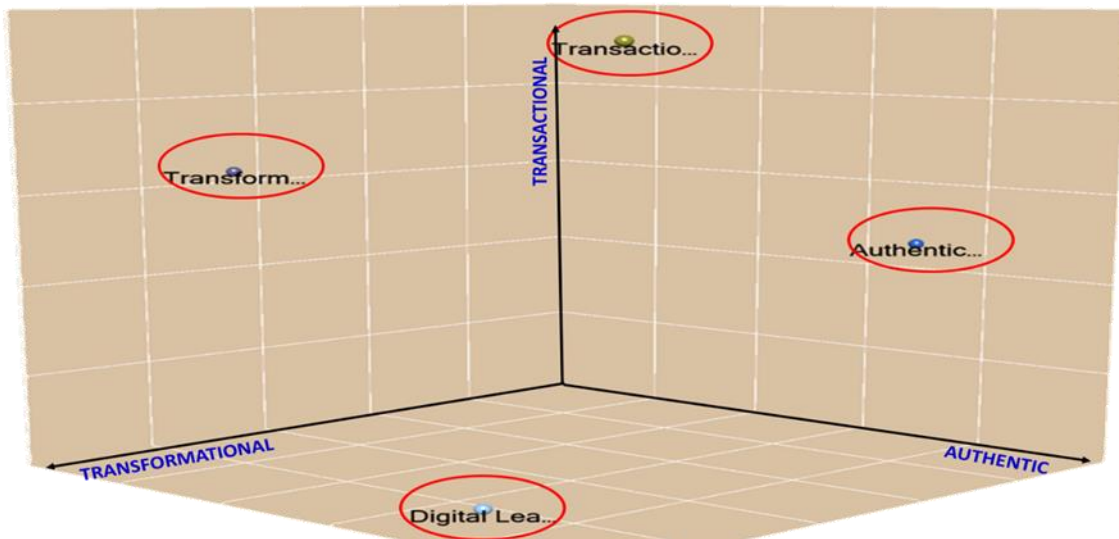
Figure 4.14. 3D Leadership Cluster Analysis with Overlaid 3D Axis

Figures 4.13 and 4.14 show how Digital Leadership positions as a stronger overlap between transformational and authentic leadership. This suggests Australian CEO's studied in this survey perceive Digital Leadership as more an authentic and transformational leadership combination.

Further cluster analysis is conducted with digital imperative constructs, analytics, connectivities, and technologies; and digital transformation constructs, skills and strategies. These are displayed below in figure 4.15.
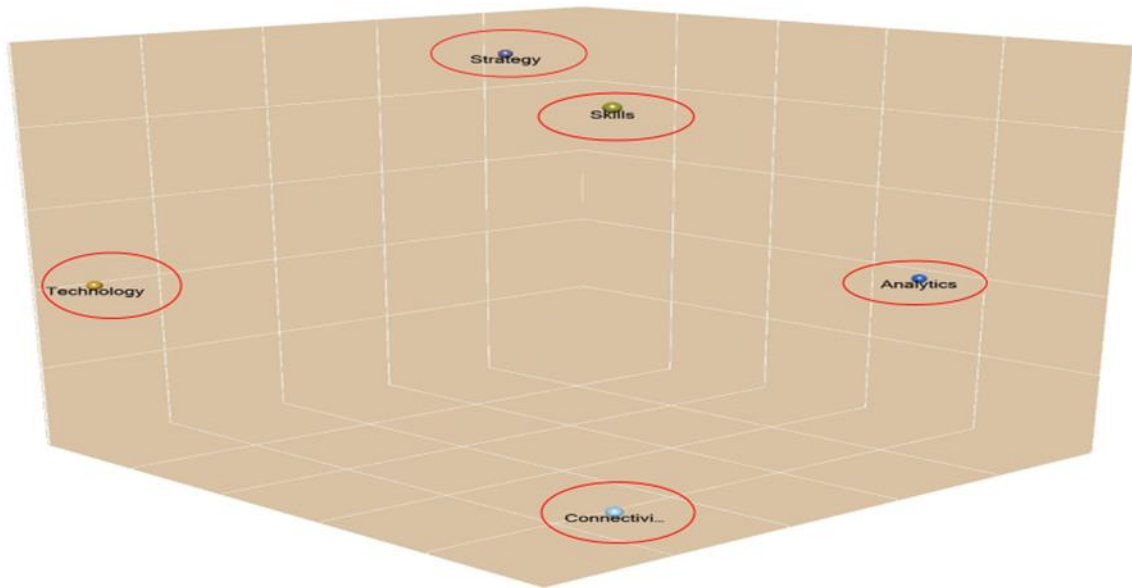
Figure 4.15. Digital Imperatives and Digital Transformation 3D Cluster Map

The cluster analysis for digital imperatives and digital transformation (See Figure 4.15) is rotated in 3D space, to show relative correlational positions of strategy and skills in the center top position near where previous transactional leadership positioned (See Figure 4.14). Analytics also positions to the right near where previous authentic leadership positioned; technology positions to the left near where transformational leadership positioned; and connectivities positions at forefront of diagram near where Digital Leadership previously positioned.

Again, a 3D axis is overlaid with digital imperatives digital transformation cluster analysis and is displayed below in figure 4.16. Figure 4.16 also provides some support for three leadership styles each influencing digital imperatives in different ways. For example, in the SEM path analysis, authentic leadership is found to have its strongest pathway with analytics, which sits near authentic leadership in the 3D cluster analysis framework (See Figure 4.16). Similarly, transformational leadership has its strongest pathway with technologies which sits near transformational leadership in the 3D cluster analysis.
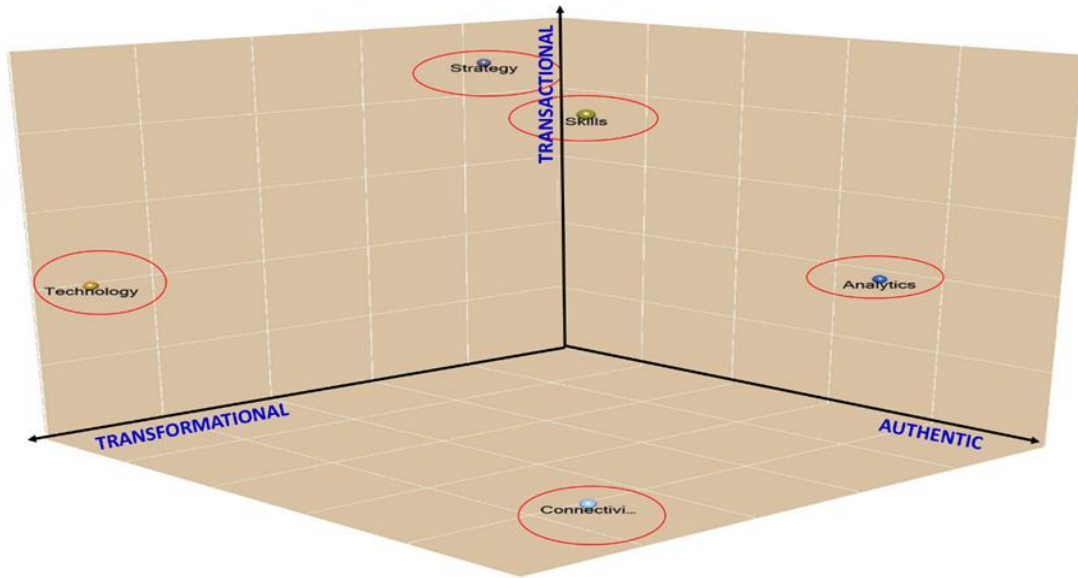
Figure 4.16. Digital Imperatives, Digital Transformation with Overlaid 3D Leadership Axis
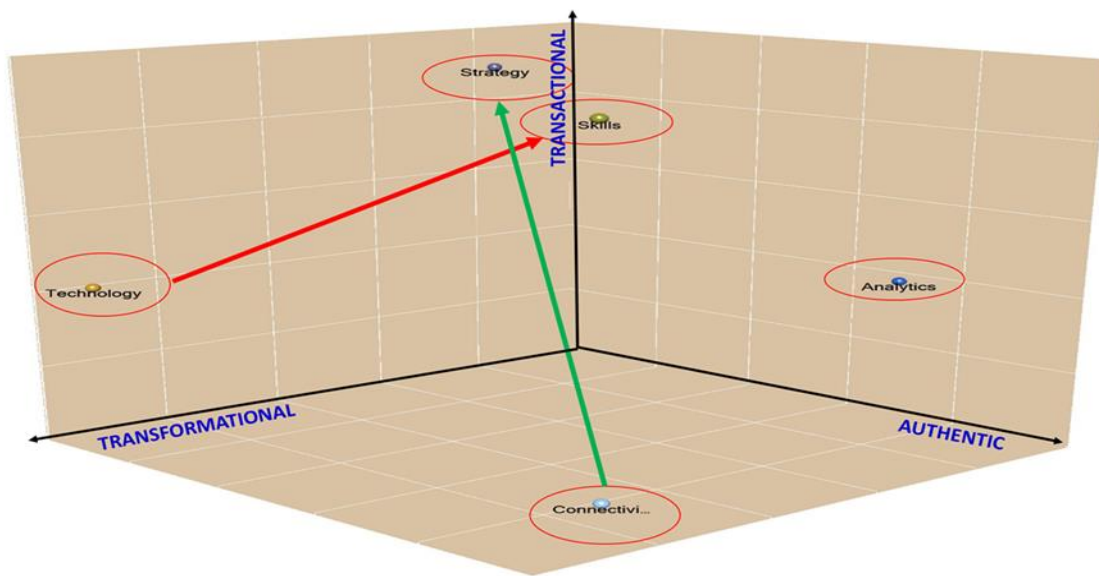
Figure 4.17. Digital Imperatives, Digital Transformation and Preferred Influencing Pathways

Figure 4.17 provides some support demonstrating how digital imperatives influence digital skills and digital strategies according to the SEM path analysis (See Figure 4.6). Technologies is the strongest driver of digital skills; and connectivities is the strongest driver of digital strategies.

Further cluster analysis (See Figure 4.18) demonstrates how two cluster analyses superimpose to understand relationships between all eight constructs. Figure 4.18

suggests authentic leadership has a likely preference towards analytics, transformational leadership has a likely preference towards technologies, and transactional leadership has a likely preference towards connectivities.
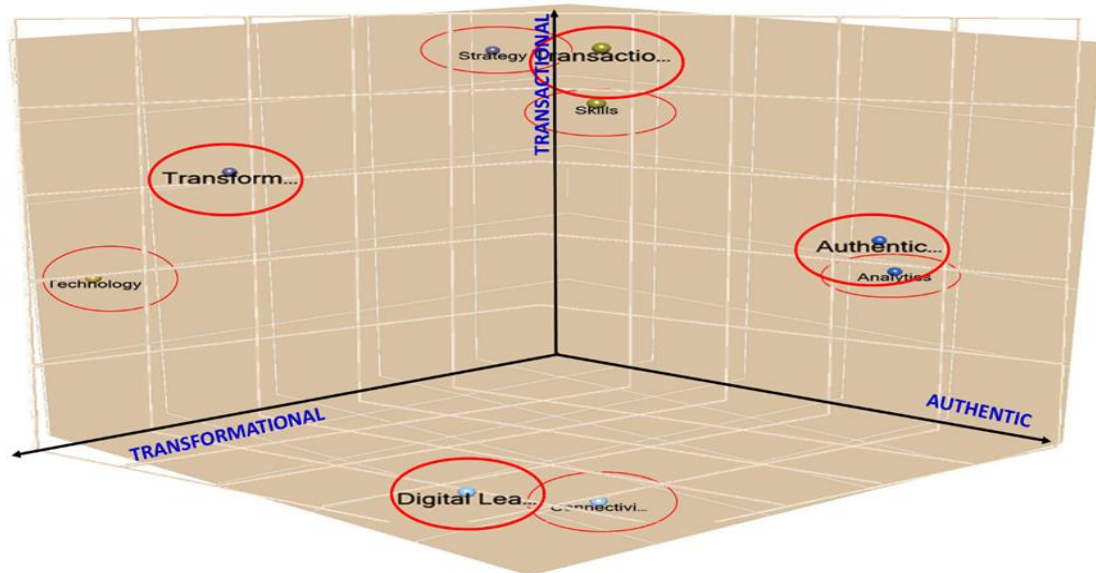
Figure 4.18. 3D Cluster Analysis of Leadership Approaches, Digital Imperatives, and Digital Transformation Overlaid

In summary, these cluster analyses suggest transformational leadership associates with technologies, transactional leadership associates with digital skills and digital strategies, authentic leadership associates with analytics and Digital Leadership positions differently in a 3D space perhaps associating with connectivities.

These findings provide further evidence multiple approaches may be used in combination to achieve digital transformation. Hence, these cluster analyses indicate alignment with the Digital Leadership Research Model (See Figure 2.4).

4.8.3.4 Directional Project Map

Further data analysis is conducted, this time exploring nodes and interconnecting relationships. Relationship nodes are coded based on the Digital Leadership Research Model SEM path model directional pathways (See Figure 4.6). These relationship nodes and construct nodes are then analyzed using project maps.

The directional project map is developed with project items (nodes and relationships) added (See Figure 4.19). This directional Project Map demonstrates shaded circles representing Digital Leadership Research Model constructs (child and parent nodes), and arrowed circles representing relationship connector pathways as per SEM path model.
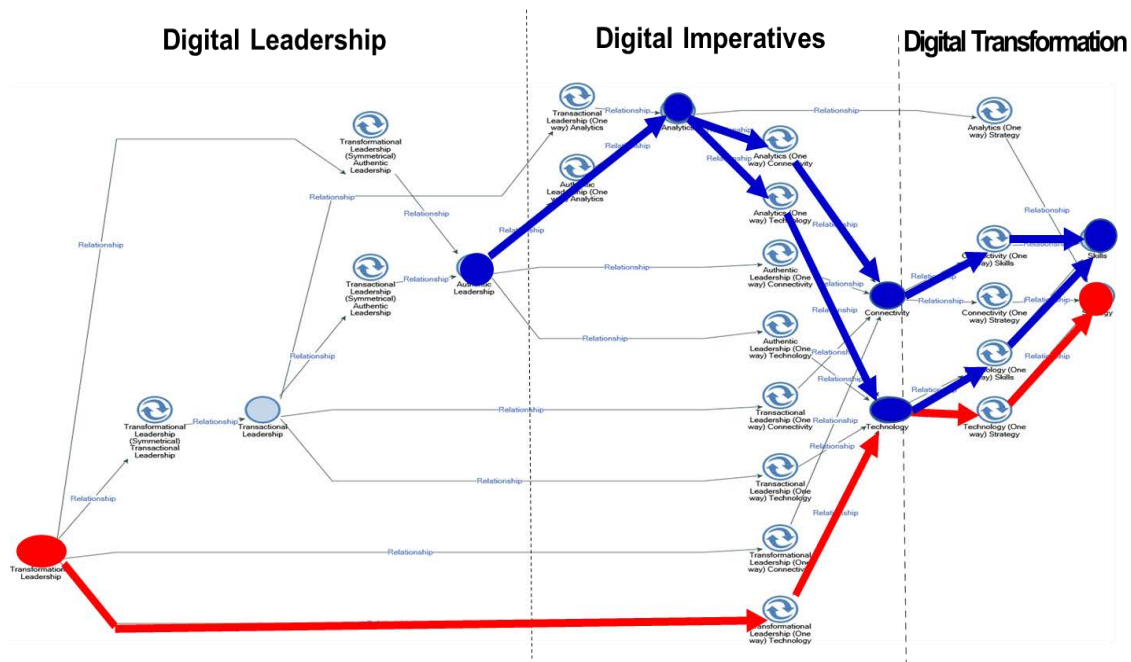
Figure 4.19. Directional Project Map Assimilating SEM Path Analysis

Here, we can see different pathways taken by each Digital Leadership approach to digital transformation through digital imperatives. Figure 4.19 demonstrates multiple unidirectional pathways, towards digital transformation outcomes, digital skills and digital strategies.

For example, highlighted pathways indicate possible pathways for achieving digital transformation. The blue pathway shows authentic leadership influencing analytics to indirectly influence digital skills via technologies and/or connectivities; and the red pathway shows a direction pathway from transformational leadership through technologies to digital strategies.

In summary, qualitative findings from word cloud, word trees, 3D cluster analyses, and directional project map provide evidence to support quantitative SEM path model (See Figure 4.6). Therefore, triangulated results from literature, quantitative and qualitative data provide high levels of validity to the Digital Leadership Research Model.

4.9 Chapter Four Summary

While aims of SEM path analysis are to test Digital Leadership Research Model and propositions; qualitative analyses aim to provide support for quantitative results. This is achieved, however this research discovered more interesting results from qualitative results over and above testing propositions.

Through Australian corporate CEOs opinions, corporates of various sizes and industries are captured through data supporting digital savviness of respondents. Results indicate a combination Digital Leadership approach; herein termed Digital Leadership may be most likely suitable for leading within the digital age corporate business world of tomorrow.

This combination approach is about in-situ leading using digital imperatives to drive digital transformation and this process may look like multiple pathways to achieve desired digital transformation. Further support is provided for a combination Digital Leadership approach, with possible three-dimensional mapping potential.

5.0 Chapter Five - Discussion & Conclusion

Providing a chapter summary addressing research question, this chapter discusses contributions and limitations and makes suggestions for further research directions.

5.1 Summary of Each Chapter

Chapter one discusses Australian corporate CEO motivations for a Digital Leadership framework and introduces the research question.

> *"Do Australian corporate CEOs influence corporate digital transformation through their application of corporate digital imperatives?'*

Chapter two examines literature focusing on three macro leadership approaches (authentic, transactional, and transformation). These literatures suggest Digital Leadership may be combination of these three macro leadership approaches. It then builds a Digital Leadership conceptual Model which is developed further into a Digital Leadership Research Model examining Digital Leadership influences on digital imperatives, which in-turn influence digital transformation.

Chapter three delivers research methodology with both quantitative and qualitative approaches. Chapter three also discusses data analysis approaches within this research.

Chapter four presents SEM path model of the Digital Leadership Research Model, along with validity and model fit explanations. It also presents qualitative analyses as pie charts, NVivo word cloud, NVivo word trees, NVivo directional project map which validate the Digital Leadership Research Model, and NVivo 3D cluster analyses attempts to position each leadership approach, digital imperatives constructs, and digital transformation constructs into relative three-dimensional positioning space.

The conceptual model, SEM path model, and NVivo results triangulate to enhance validity of the Digital Leadership Research Model.

5.2 Research Findings

This research finds three macro leadership approaches (authentic, transactional, transformational) likely overlap, and when combined may be defined as Digital Leadership. Further, each leadership approach drives three digital imperatives (analytics, connectivities, technologies) in different ways. Authentic leadership indicates an analytics preference. Transactional leadership indicates connectivities preference. Transformational leadership indicates technologies preference.

Further, findings indicate digital imperatives influence digital transformation (skills, strategies) through different pathways. For example, when considering digital imperatives both technologies and connectivities have direct path influence on digital strategies and digital skills and while analytics directly influences digital strategies, it indirectly influences digital skills.

5.3 Real-World Contribution

Quantitative analysis indicate Australian corporate CEOs perceive different digital imperative pathway combinations to digital transformation as relevant. This study's Digital Leadership Research Model can prescribe many options for different corporates. Further, findings indicate different leadership approaches to digital transformation may vary among Australian corporate CEOs.

This may indicate different Digital Leadership maturity within Australian corporates which, is evidenced by levels of reported CEO digital savviness. For example, Australian corporate Rio Tinto, which is data rich has adopted an analytics pathway approach to their digital transformation (Crozier, 2018) and therefore may have strong digital savviness.

Rio Tinto with revenues of $47 billion and over 66,000FTE across 40 countries, is one of the largest global mining and metals companies (World Economic Forum, 2015). In developing their 'Mine of the Future' Rio Tinto have digitally transformed over time, developing a flatter organization, establishing new technologies, creating new analytics measures, and have digitally connected mines for operational efficiency into a centralized intelligence hub (Rio Tinto, 2018). Rio Tinto's continued digital transformation began more than eleven years ago through a technological innovations pipeline and partnering alliances with industry, business, science and academia.

In revealing their digital transformational future, Rio Tinto plans to create their first 'Intelligent Mine', Rio Tinto says they shall network all assets together, using analytics capabilities to make decisions in microseconds (Crozier, 2018). In line with this research's Digital Leadership Research Model, Rio Tinto are using data-driven analytics (digital imperatives) to drive their continued digital transformation. Rio Tinto provided the digital skills and capabilities frameworks to empower workers with user-friendly software applicable for complex data analysis. This allows the company to make wise informed decisions remotely from their digital control room.

Leading through their internal research pipelines, Rio Tinto develop their own leading-edge technologies including automated trucks, drills and trains, and leading systems to connect all components of schedule from customer through to orebody planning (Crozier, 2018).

Further use of Artificial Intelligence (AI) and big data provides support for digital transformation of end-to-end scheduling.

In terms of making a true impact when connecting people, processes and things, Rio Tinto's digital transformation as a 'Mine of the Future' is recognized and applauded by the World Economic Forum (2015) for augmenting people and computers to work together, rather than viewing humans and machines as mutually exclusive knowledge sources.

Throughout the above mentioned continuing digital transformation process, Rio Tinto have always remembered development of leaders, and workforce. Former Rio Tinto CEO, Sam Walsh who is instrumental in developing an innovations culture at Rio Tinto (Brookes, 2018), displayed transformational leadership qualities through his vision of transforming Rio Tinto's mining sites into a 'Mines of the Future' approach.

Walsh spurred Rio Tinto to transform itself through technologies innovation and displayed transactional leadership through delivering nearly $500 million in savings from autonomous projects. Further Walsh displays authentic tendencies through working in real-time with technology and not putting boundaries around extent to which digital transformation may be limited by.

This Rio Tinto corporate example demonstrates this study's Digital Leadership Research Model applicability to a real-world setting. The Digital Leadership Research Model demonstrates multiple pathways corporates like Rio Tinto, can follow in the real-world to implement a chosen digital transformation.

Another example of Australian digital transformation is adoption of block-chain technology among the four big banks. CBA bank has been the first global bank appointed by The World Bank for the first bond deal on block-chain technology (Eyers, 2018).

The use of block-chain offers CBA transparency, reporting and reduced operational risk, with digital currencies moving to real-time and secondary markets (Eyers, 2018). Although a long way from achieving total digital transformation, the CBA say this is the first step towards how capital markets can look in the future.

Contrasting with Rio Tinto, which has used an analytics imperatives approach toward their digital transformation, the CBA approach is adapting an emerging technologies imperative towards delivery their desired digital transformation. This again demonstrates the real-world applicability of this Digital Leadership Research Model and another set of different digital pathways possibility towards delivering a digital transformation.

Demonstrating a technologies and connectivities, and analytics approach, the digital imperatives being used by Australian corporates to drive digital transformation are implemented differently, possibly through options offered within the Digital Leadership Research Model. Through using different approaches, corporates leaders can potentially use the Digital Leadership Research Model to improve their digital transformation efficiencies and effectiveness.

Digital transformation in Australia has an adoption rate of only 8% (Beresford, 2018), because Australian corporates have only in part attempted, and not fully achieved complete digitization (Banney, 2018). Australian corporates are still in early stages of digital transformation. They see digital transformation as a key priority (80%), with 60% aiming to reach digital maturity by the year 2020. They recognize strong Digital Leadership is likely essential for any future digital transformation.

Rio Tinto (Banney, 2018), and DBS Bank (Sia et al., 2016) were champions of creating corporate digital transformations. They first cultivated a strong Digital Leadership approach before moving into a full transformation process. To achieve this, they each engaged a different suite of digital imperatives tools.

The banking examples and the Rio Tinto example are indicators of digital savviness of Australian corporate CEOs. However, depending on level of digital transformation implementation these CEOs are at, they may need time to action these digital transformation strategies. This Digital Leadership Research Model therefore, is a timely approach for Australian corporate CEOs embarking on a future road-map towards their desired digital transformation.

Qualitative analysis provides support for the Digital Leadership Research Model being used for successful digital transformation. The nine open-ended questions reveal top two digital skills are communications (connectivities) and digital savviness (technologies), followed by leadership and analytics. The top digital strategies are digital savviness (technologies), corporate strategies, and communications (connectivities).

NVivo word cloud reveals digital transformation is not top-of-mind for Australian corporate CEOs, with transformation not ranking very highly on word frequency. However digital is the most frequented word indicating although digital is top-of-mind for Australian corporate CEOs, transformation isn't.

Other word frequencies included communication (connectivities), technology, analytics, skills, and strategy which all appeared larger (and more frequently used) than the word

transformation. The word cloud provides a clear indication Australian corporate CEOs are aware of digital transformation yet are not generally actioning such transformation.

NVivo word tree developed around the most frequently used word digital is indicative of several Australian corporate CEOs using phrases such as 'technologies can improve performance and customers' and 'transformation that enables operational innovation'. The word tree is indicative of Australian corporate CEOs conceptually linking ideas of how to build digital changes, but it shows a lack of clear digital operations approach.

This may indicate a gap in Australian corporate CEOs thinking between strategy and operational levels. Nevertheless, the word tree demonstrates Australian corporate CEOs are aware of different pathways in which to build their digital transformation.

NVivo 3D cluster analyses provide correlational support Australian corporate CEOs may use combination of three leadership approaches to drive digital transformations in their corporate. SEM path analysis is indicative of overlap between the three leadership approaches, with strongest covariance (p< 0.001), between authentic and transformational leadership. Significant covariance relationships Digital Leadership as defined herein, may sit within the overlap of these three leadership approaches.

The three-dimensional cluster analyses are superimposed on three leadership approaches within a three-dimensional axis framework. This study notes a possible overlap across authentic, transactional, and transformation leadership. The three-dimensional cluster analysis and SEM path analysis provide some triangulated support Digital Leadership is likely a combination of three macro leadership approaches engaged herein.

In summary, triangulated quantitative and qualitative data indicate high levels of support for the Digital Leadership Research Model. Real-world examples of Rio Tinto and Australian banks provide further support and evidence towards real-world applicability of the Digital Leadership Research Model.

5.4 Research Contributions

This thesis offers a better understanding around definition of Digital Leadership. The literature considers Digital Leadership from CIO, CTO, CMO, CDO, COO and executive viewpoints. These viewpoints have evolved recently as necessary positional steps towards nurturing and establishing Digital Leadership.

This thesis provides an explanation Digital Leadership may be three-dimensional. This study indicates a true Digital Leader may be a CEO, a board member, or any of c-suite members mentioned above. Through defining the Digital Leadership concept, as a

corporate leadership approach to lead in the digital age (Gartner, 2018), this research provides a good start-up position for future directions around Digital Leadership research and development.

Like George's (2010) definition of the new 21st century leader, as aligning, empowering, serving, and collaborating with others; and O'Connell's (2014) framework for today's leader development using a simplified approach to a changing environment for leaders. The Digital Leadership Research Model offers an approach for understanding today's leadership. In evolving this model, the framework of Digital Leadership condenses explanation of complex relationships into an understandable process.

The Digital Leadership Research Model offers a good option to start direction into tomorrow's Digital Leadership. This thesis defines Digital Leaders as being different to traditional leaders, and like tomorrow's leader (O'Connell, 2014) they flatten the organization, focus on customers, and deliver sustainable performance (George, 2010). Therefore, this thesis may contribute to direction of where tomorrow's leadership may move in the digital age.

5.5 Research Limitations

5.5.1 Practical Limitations

Practical limitations are considering during this research. These potentially included threats to validity such as construct, internal and external and statistical conclusion.

Internal validity is indicated by extent of which statements made about causal relationships and whether constructs are manipulated or measured (Cook & Campbell, 1979). Internal threats are identified and discussed in research design and results section. For example, observed results may be influenced by choice of respondent's location, which is overcome by using one generic location for all participants, the social media platform LinkedIn.

External validity may possibly be threatened whenever conditions inherent to research design are such as generalizability of results is limited (Cook & Campbell, 1979). External validity is supported through generalisation of these results across Australian corporate CEOs, who maybe considering or ready to lead digital transformation.

Construct validity refers to possibility constructs can be developed in terms of more than one construct, each of which is at same reduction level (Cook & Campbell, 1979). The measures in this research are developed according to validity of previous measurement

items. These have high construct validity evidenced by performing confirmatory factor analysis and reduction and confirming Cronbach alpha reliability.

Statistical conclusion validity may include measurement errors cannot be controlled (Galliers, 1992). The presence of random errors cannot threaten statistical conclusion. Such threats may include low statistical power, violated assumptions, error-rate problems, random irrelevancies, and random heterogeneity of respondents. Treatment of data in this research indicates statistical conclusions about relationships between constructs are reasonable and true. For example, minimum required sample size is 20:1 case per construct for SEM, and this is satisfied with 165 cases herein this research (Hair et al., 2010).

5.5.2 Theoretical Limitations

As previous literature helps lay a foundation for understanding the research problem. There is inconclusive theoretical research in this area of research, hence an exploratory research design is applied. Zhu et al. (In Press) research on landscape and evolution of leadership summarises many leadership approaches overlap in overarching leadership theories, with many fittings within three approaches discussed herein. Based on overarching theories as laid out in Zhu et al. (In Press) research, this research articulates a possible definition of Digital Leadership to explain the research problem.

Literature limitation also extended to knowledge around evolution of the digital age. Practice literature from sources such as Harvard Business, KPMG, and Deloitte Digital provided inspired direction for testing theoretical assumptions led to understanding the digital age and how knowledge acquisition is rapidly paced.

This research combines overarching leadership theories of Zhu et al. (In Press) research which gives rise to definition of Digital Leadership and knowledge around evolution of the digital age. Hence this research proposed the Digital Leadership Research Model.

5.6 Future Research

This thesis and research results herein may contribute several areas future theoretical and research in practice. Future research may balance research and practice, through developing action research models in recursive relationship. Like academic research supports practice research but with rapid built-in feedback loops to practice through implementation. While answering the call for practical solutions.

One possible research extension includes investigating corporates in case study analysis, or rather, research in action; and studying trickle-down effects of Digital Leadership to workforce implementation. Extensions of this research may include implementing and testing the Digital Leadership Research Model as an organizational development model using design science methodology or action research.

Replicating this study with ASX CEOs and using a recursive developmental model between Digital Leadership and digital imperatives may support outcomes of digital transformation as a change and development model. In terms of measuring traditional business vs digital business (e-commerce vs traditional commerce), this approach may provide a deeper understanding of how Digital Leadership develops transition required for digital transformation. Hence, supporting adaptability of the Digital Leadership Research Model as number one digital transformation solution.

This current study may be conducted as a developmental model as described above, with global CEOs. This may provide cross-cultural applicability of the model in terms of Digital Leaders functioning in a macro digital environment regardless of country as global digital environmental boundaries. This may provide further support for the Digital Leadership Research Model in a global context to understand specific location understanding of different pathways to digital transformation transition currently in play, such as Germany being ahead in Industrie 4.0 (Geissbauer, Vedso & Schrauf, 2016).

Further interesting research may include contrasting cross-country focus on highly industrialised countries with those untouched by the digital age and technologies.

A future research direction may include refining the Digital Leadership measurement scale to include full Authentic Leadership Questionnaire (ALQ) (Avolio et al., 2007), and full range Multi-factor Leadership Questionnaire (MLQ) (transactional-transformational leadership measure) (Bass & Avolio, 1995). This may improve Digital Leadership understanding of how overlap between these three leadership approaches fits, while considerably improving theoretical foundation of Digital Leadership.

Consequently, testing different thematic approaches with the Digital Leadership Research Model may enable better understanding of possible three-dimensional leadership approach discussed within this research and thesis, while supporting possible future development potential.

5.7 Chapter Five Summary

How we evolve and transition the digital age is important, especially around evolution of working environments such as corporates. This is because they provide continued employment for many people. In the spirit of continuity of employment for many, it is important to develop competitive digital business models, so corporate can evolve and better position itself in the global digital market.

The global big picture is the world is currently moving into and through the fourth industrial revolution (Industrie 4.0) very rapidly, which is why human evolution and using digital technologies to evolve and change the way in which we do things is important. This research therefore, is important for helping many people evolve the digital age through corporate work environments and developing Digital Leaders to lead this evolution.

By increasing clarity and understanding around how, why, where, what, and when we digitally transform, this can make transition flow more smoothly. Especially in providing easy simple to use solutions for implementing digital transformation through innovative Digital Leadership pathways. Further, digital imperatives present opportunities to evolve corporates to new raised levels of performance through digital transformation, and to transition the digital age.

Hopefully, this thesis inspires Australian corporate CEOs, like this research is inspired to achieve digital age adaptability. Adaptability refers to ability to evolve and transition digital age through digital transformation. Further goals around continued working with Australian corporate CEOs to better understand Australian corporate needs around digital transformation, digital strategies and digital skills development may further help position Australia more competitively in the global digital marketplace, further benefitting Australia as a whole.

This research and thesis meet its goals and motivation of providing simplified explanation of complex terminology in a way designed to assist Australian corporate CEOs improve their digital performance. It also provides possible three-dimensional road-mapping options for digital transformation. Consequently, future possibilities of developing a highly digitalised country with many Digital Leaders is exciting vision of which I hope all readers may share.

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APPENDIX A – The Questionnaire

As a corporate leader, I:	**Strongly Disagree**		**Neutral**		**Strongly Agree**
1. Reinvent our business processes	○	○	○	○	○
2. Always build smarter internal business communication systems	○	○	○	○	○
3. Innovatively change our business processing systems	○	○	○	○	○
4. Drive new innovations into our product offerings	○	○	○	○	○
5. Seek new technologies to create new business opportunities	○	○	○	○	○
6. Proactively seek new opportunities to advance our business boundaries	○	○	○	○	○
7. Provide recognition when staff achieve my strategic goals	○	○	○	○	○
8. Negotiate productivity with my team	○	○	○	○	○
9. Ensure my workforce is digitally savvy and flexible	○	○	○	○	○
10. Motivate my workforce towards benefiting our customers	○	○	○	○	○
11. Allow our business to align and transact directly with our customers	○	○	○	○	○
12. Promote digital sales/marketing to expand our revenue growth	○	○	○	○	○
13. Determine our minimum requirements workforce	○	○	○	○	○
14. Strategically determine our management levels	○	○	○	○	○
15. Use my core beliefs to further specialize our business	○	○	○	○	○
16. Continually improve the preciseness of our corporate's information	○	○	○	○	○
17. Precisely convey corporate leadership perspectives to our workforce	○	○	○	○	○
18. Am focused on real-time solutions	○	○	○	○	○

As a corporate leader with a focus on strategic financial my priorities are:

19. Sharing and communicating knowledge	○	○	○	○	○
20. Digital business transformations	○	○	○	○	○
21. Interconnected digital technologies platforms	○	○	○	○	○
22. Big data analytics capabilities	○	○	○	○	○
23. Future investment into digital operations	○	○	○	○	○
24. Digital platforms to transform business value chains into value networks	○	○	○	○	○

As a corporate leader my strategic human capital priorities are:

25. Digital knowledge to enhance workforce collaboration	○	○	○	○	○
26. A collaborative digital culture to encourage knowledge sharing	○	○	○	○	○
27. Restructuring existing silos to nurture a collaborate digital culture	○	○	○	○	○
28. Digital skills to improve business processing	○	○	○	○	○
29. A digital servicing culture to engage our customers	○	○	○	○	○
30. Digital culture and training to foster new ways of doing things	○	○	○	○	○
31. Social network connectivities to broaden our communities reach	○	○	○	○	○

To enhance our strategic technical capabilities I enlist:

32. Digital global cloud connectivities	○	○	○	○	○
33. Smart digital technologies that empower our workforce	○	○	○	○	○
34. Intelligently connected digital ecosystems that further enable our business opportunities	○	○	○	○	○
35. Smart technologies to integrate our operations	○	○	○	○	○
36. Corporate digital innovations to further transform our business	○	○	○	○	○
37. Innovations to change our competitive landscape	○	○	○	○	○

To enhance our strategic performances I use Corporate:

38. Digital capabilities to monitor our competitors	○	○	○	○	○
39. Our real-time digital dashboard indicators to refine business priorities	○	○	○	○	○
40. Digital channels to collaborate with our stakeholders	○	○	○	○	○
41. Strategic roadmap to develop our big data analytics capabilities	○	○	○	○	○

| 42. | Data analytics to broaden our customer transactions | | ○ | | ○ | | ○ | | ○ | | ○ |
| 43. | Data analytics to enhance our customer intelligences | | ○ | | ○ | | ○ | | ○ | | ○ |

PLEASE TELL US A LITTLE ABOUT YOURSELF

44.	Gender			Female	○	Male	○				
45.	Please indicate your age:			Under 30	○	30-45	○	46-60	○	Over 60	○
46.	Highest formal education:			Secondary	○	Degree	○	Post-graduate	○	Other	○
47.	Corporation size:	< 1000	○	1001-5000	○	5001-10000	○	10001-50000	○	>50000	○

48.	How Digitally Savvy are you?	Very High		High		Average		Low		Very Low
		○		○		○		○		○

49.	How long in your current position			Years			

50.	Interested in an interview with diagnostic feedback:	Yes	○	Contact details	

What three capabilities a leader should have in the digital age? (fill in below)

51.	
52.	
53.	

What three attitudes a leader should have in the digital age?

54.	
55.	
56.	

What three skills a leader should have in the digital age?

57.	
58.	
59.	

60.	What position do you hold	CEO	○	Board Member	○	Exec Member	○	Senior Manager	○	Other	○

Please indicate your proficiency:

		Now		12Mths		Future	
61.	Cloud Information & Collation	○		○		○	
62.	Internet of Things (IoT)	○		○		○	
63.	Business Process Reegineering (BPR)	○		○		○	
64.	Industrie 4.0 Digitization	○		○		○	
65.	Innovative Hype 1, 2	○		○		○	
66.	e-business	○		○		○	
67.	e-commerce	○		○		○	
68.	m-commerce	○		○		○	
69.	e-economy (big data analytics)	○		○		○	
70.	Business-consumer service value networks (B-C SVNs)	○		○		○	
71.	High performing workforce teams						
72.	Workforce talent management	○		○		○	
73.	Personalised customer satisfaction	○		○		○	

		Disagree	Neither Agree or Disagree	Mildly Agree	Agree	Strongly Agree
74	Individualised customer loyalty		○		○		○	

(Note: item 74 has circles in alternating positions across a wider grid)

	As a digital corporate leader into the future, I need to know:	Disagree	Neither Agree or Disagree	Mildly Agree	Agree	Strongly Agree
75	What performance measures monitor digital strategy	○	○	○	○	○
76	How to interpret digital age operations against digital strategies	○	○	○	○	○
77	About current digital business technologies	○	○	○	○	○
78	The potential value of current digital age business technologies	○	○	○	○	○
79	How to change corporates future technology dependencies	○	○	○	○	○
80	The unique capabilities associated with Digital Leadership	○	○	○	○	○
81	How each digital product adds value to customers	○	○	○	○	○
82	How my digital servicing adds value to customers	○	○	○	○	○
83	How to incorporate current and future technologies into my corporate digital strategy	○	○	○	○	○

As a digital corporate leader into the future, I

		Disagree	Neither Agree or Disagree	Mildly Agree	Agree	Strongly Agree
84	Quickly upskill on using new and emerging technologies	○	○	○	○	○
85	Understand technologies that can mine our corporate data	○	○	○	○	○
86	Apply technologies that identify, track, and mine our corporate data	○	○	○	○	○
87	Exploit data information relevant to my needs	○	○	○	○	○
88	Use emerging digital technologies to analyse my business' competitiveness	○	○	○	○	○
89	Demonstrate knowledge of digital infrastructure costs	○	○	○	○	○
90	Demonstrate knowledge of digital infrastructure and its use	○	○	○	○	○
91	Implement effective corporate business technologies	○	○	○	○	○
92	Implement new technology advances	○	○	○	○	○
93	Assess business technologies investment risks	○	○	○	○	○
94	Nurture the strategic digital culture of my corporate	○	○	○	○	○
95	Build strategic digital talents throughout my corporate	○	○	○	○	○
96	Champion technology-enabled value adding innovations	○	○	○	○	○
97	Evaluate industry trends across new and emerging technologies	○	○	○	○	○
98	Consider myself a 'fit-for-purpose' digital age corporate leader	○	○	○	○	○
99	I have the resources to transform my corporation into a digital age operation	○	○	○	○	○

APPENDIX B – Overarching Theories with Leadership Approaches

Over-arching Theories	Transformational	Transactional	Authentic	Leader-member Exchange	Servant	Shared	Trait Theory	Strategic	Empowering	Implicit	Identity-based	Ethical	Abusive	Self-sacrificing	Emergent	Followership	Emotions & Leadership	Diversity & Cross-cultural	Complexity	Paternalistic	Paradoxical	Participative
Social Cognitive Theory	✓	✓		✓	✓	✓						✓										
Social Exchange Theory	✓		✓		✓		✓					✓	✓		✓	✓						
Social Identity Theory	✓		✓							✓	✓	✓			✓		✓					
Upper Echelons Theory	✓	✓				✓		✓				✓										
Job Characteristics Theory	✓																					
Goal Setting Theory	✓				✓	✓	✓															✓
Trait Activation Theory	✓						✓															
Social Learning Theory		✓	✓		✓	✓						✓	✓									
Self-determination Theory			✓		✓										✓	✓						
Role Incongruity Theory			✓																			
Self-discrepancy Theory			✓																			
Affective Events Theory			✓																			
Social Exchange Theory				✓																		
Network Theory				✓																		
Open System Theory				✓																		
Regulatory Focus Theory					✓																	
Functional Leadership Theory						✓																
Socio-technical Systems Theory						✓																
Self-control Theory						✓																
Expectancy Theory						✓																
Path-goal Theory						✓													✓	✓	✓	✓
Equity Theory						✓																
Reinforcement Theory						✓																
Leadership Categorisation Theory							✓															
Socio-analytic Theory							✓															
Role Theory							✓						✓					✓				
Theory of Core Evaluations							✓															
Self-efficacy Theory							✓															
Role Identity Theory									✓													

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Over-arching Theories	Leadership Styles																					
	Transformational	Transactional	Authentic	Leader-member Exchange	Servant	Shared	Trait Theory	Strategic	Empowering	Implicit	Identity-based	Ethical	Abusive	Self-sacrificing	Emergent	Followership	Emotions & Leadership	Diversity & Cross-cultural	Complexity	Paternalistic	Paradoxical	Participative
Cognitive Moral Development												✓										
Social Information Processing Theory												✓										✓
Conservation of Resources Theory												✓										
Affective Events Theory												✓										
Self-Regulation Theory												✓										
Theory of Moral Reasoning												✓										
Moral Development Theory												✓										
Theory of Moral Judgement												✓										
Behavioral Plasticity Theory												✓										
Demand Control Theory of Stress												✓										
Self-regulation Impairment Theory												✓										
Self-gain View												✓										
Conservation of Resources Theory												✓										
Attribution Theory												✓										✓
Social Information Processing Theory												✓										
Moral Exclusion Theory												✓										
Reactance Theory												✓										
Power/ Dependence Theory												✓										
Social Categorizing Theory														✓								
Self-identity Theory																✓						
Affective Events Theory																	✓					
Value/ belief Theory of Culture																		✓				
Implicit Motivation Theory																		✓				
The Integrated Theory																		✓				
Structural Contingency Theory																		✓				

Source: Zhu et al. (In Press), pp5-6

APPENDIX C – Measurement Item Development for Constructs

THE DIGITAL LEADERSHIP RESEARCH MODEL CONSTRUCT MEASUREMENT ITEMS DEVELOPMENT				
DIGITAL LEADERSHIP RESEARCH MODEL MEASUREMENT ITEMS	**REFERENCES**	**MEASUREMENT ITEMS**	**AIM**	**ASSESSMENT**
DIGITAL LEADERSHIP	N/A	**No genuine measure**	**Digital Leadership**	**For Digital Leadership**
AUTHENTIC LEADERSHIP	**Walumbwa et al. (2008) Whitehurst (2015)**	**Self-awareness – transparency – ethical/moral – balanced processing**	**Creating and communicating a compelling vision and strategy.**	**Assesses how authentic leaders engage the workforce for digital transformation.**
As a corporate leader I;		**[1] genuine measure [2] digital version**	**To lead in the digital age.**	
Continually improve preciseness of our corporate's information	Walumba et al. (2008) Whitehurst (2015)	[1]I listen closely to ideas of those who disagree with me. [2]Digital leaders should teach workforce digital trends in information sharing.	Balanced processing	Assesses leader's continual focus of improving efficiency and effectiveness through challenging ideas from others.
Precisely convey corporate leadership perspectives to our workforce	Walumba et al. (2008) Whitehurst (2015)	[1]Other people know where I stand on controversial issues. [2]Leaders put in place KPIs for knowledge sharing & coaching others.	Relational Transparency	Assesses extent to which the leader communicates their intentions and beliefs to the workforce
Am focused on real-time solutions	Walumba et al. (2008) Whitehurst (2015)	[1]I listen very carefully to ideas of others before making decisions. [2]CEOs should understand digital opportunities and threats in real-time.	Self-awareness	Assesses leaders use of digital channels to make real-time decisions.
TRANSACTIONAL LEADERSHIP	**Northouse (2010) Whitehurst (2015)**	**Management by exception – contingent reward -**	**Putting in place and managing people, processes and technology to execute strategy.**	**Assesses transactional leader's ability to manage people and processes during digital transformation.**
As a corporate leader I;		**[1] genuine measure [2] digital version**	**To lead in the digital age.**	

THE DIGITAL LEADERSHIP RESEARCH MODEL CONSTRUCT MEASUREMENT ITEMS DEVELOPMENT				
DIGITAL LEADERSHIP RESEARCH MODEL MEASUREMENT ITEMS	REFERENCES	MEASUREMENT ITEMS	AIM	ASSESSMENT
Improve digital sales/marketing to expand our revenue growth	Northhouse (2010) Whitehurst (2015)	[1]I keep track of all mistakes. [2]Through failure leaders understand how to improve sales/marketing revenue.	Management by Exception - Incentives	Assess degree to which the leader uses mistakes to improve performance.
Allow our business to align and transact directly with our customers	Northhouse (2010) Whitehurst (2015)	[1]I make clear what one can expect to receive when performance goals are achieved. [2]We get our best results working side by side with customers and this leverages business.	Contingent reward	Assesses extent to which leaders set goals, make rewards contingent upon performance, obtain necessary resources, and provide rewards when performance standards have been met.
Ensure my workforce is digitally savvy and flexible	Northhouse (2010) Whitehurst (2015)	[1]Rewards and recognizes workforce achievements. [2]Leader puts together a multi-dimensional framework to increase knowledge & skills.	Contingent reward - praise	Assesses how leaders enforce rules around skills development using rewards.
Motivate my workforce towards benefiting our customers	Northhouse (2010) Whitehurst (2015)	[1]Express satisfaction when workforce meets expectations – group level. [2]Marketing follows pattern of research, engage, try, & learn.	Manage by Exception - Motivate workforce	Assesses how leaders develop structures around rewards and loyalty programs.
TRANSFORMATIONAL LEADERSHIP	**Northouse (2010) Whitehurst (2015)**	**Intellectual stimulation – individual consideration – inspirational motivation – idealized influence – change focus**	**Creating and communicating a compelling vision and strategy.**	**Assesses how transformational leaders lead digital transformation.**
As a corporate leader I;		**[1] genuine measure [2] digital version**	**To lead in the digital age.**	
Innovatively change our business processing systems	Northhouse (2010) Whitehurst (2015)	[1]I talk and behave optimistically about the future.	Inspirational Motivation - Inspirational networker & promoter -	Assesses leader's ability to articulate a compelling vision of the future, as well as the

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		[2]Digital Leaders paint a picture of digital future to innovate changing business processes.	Communicates vision, and builds potential	degree to which he/she sets challenging standards and takes a stand on controversial issues.
Always build smarter internal business communication systems	Northhouse (2010) Whitehurst (2015)	[1]I re-examine critical assumptions to question whether they are appropriate. [2]Digital communication skills help drive the business forward.	Intellectual Stimulation - Critical & strategic thinking - Decision-making, ethical, questions tradition	Assesses how leaders point out problems in current situations and contrasts them with the vision of the future.
Reinvent our business processes	Northhouse (2010) Whitehurst (2015)	[1]I go beyond self-interest for the good of the group. [2]Leaders create a common lexicon to increase understanding from perspective of business processes and outcomes.	Idealized Influence - Involves others – develops others – political sensitivity	Assesses degree to which the leader instils pride, displays power & confidence, makes personal sacrifice, considers ethical consequences, and talks about importance of having a collective sense of mission
DIGITAL IMPERATIVES		**Digital Imperatives are digital tools used for shaping the transition to digital transformation**	**Digital tools.**	**Assesses how leaders use digital imperatives for digital transformation.**
ANALYTICS	**Sia et al. (2016) Whitehurst (2015)**	**Extent to which leaders use analytics to understand and predict corporate direction. Sia et al. (2016)**	**To enhance strategic performance.**	**Assesses analytics usage.**
To enhance our strategic performance I use;			**To increase strategic performance.**	**Assesses leader's use of analytics for enhancing strategic performance.**
Data analytics to broaden our customer transactions	Sia et al. (2016) Whitehurst (2015)	Understanding customer needs through data collection and analysis.	To strategically enhance revenue.	Assesses leader's strategic ability to use analytics to increase revenue.

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Data analytics to enhance our customer intelligence	Sia et al. (2016) Whitehurst (2015)	Data analytics leads to smarter business moves and happier customers, which leads to higher profits.	To strategically understand customers.	Assesses leader's strategic ability to use analytics to better understand customers.
Strategic road-map to develop our big data analytics capabilities	Sia et al. (2016) Whitehurst (2015)	Develop a business case or road-map for digital strategy.	To strategically plan for development of data analytics capabilities.	Assesses leader's strategic ability to grow analytics capability.
Digital capabilities to monitor competitors	Whitehurst (2015)	Digital acumen is becoming a critical enabler of business on all fronts and levels.	To strategically monitor competitors.	Assesses leader's strategic ability to analysed complex competitive markets.
CONNECTIVITIES	**DasGupta (2011) Sia et al. (2016) Whitehurst (2015)**	**Extent to which leaders connect and collaborate their workforce to a digital future. Sia et al (2016)**	**Strategic human capital priorities - network**	**Assesses human capital networking potential.**
As a corporate leader, strategic human capital priorities I include are;			**To strategically develop a collaborative connected and networked culture.**	**Assesses leaders strategic human capital priorities**
A collaborative digital culture to encourage knowledge sharing	DasGupta (2011)	The greatest leadership challenge is how to make the workforce work collaboratively to create a culture allowing all voices of leadership to be heard.	To strategically build a collaborative culture	Assesses leader's strategic ability to develop a knowledge sharing culture in the workforce, imperative for the digital age.
Digital knowledge to enhance workforce collaboration	DasGupta (2011)	Collaborative innovation networks generate swarm creativity through digital concepts.	To strategically enhance workforce digital IQ.	Assesses leader's strategic ability to enhance knowledge sharing for a collaborative workforce.
Restructuring existing silos to nurture a collaborate digital culture	Whitehurst (2015)	Silos are key barriers to digital business development and holding organization back.	To strategically restructure silos.	Assesses leader's strategic ability to break down existing silos preventing a collaborative digital culture.

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Digital skills to improve business processing	Whitehurst (2015)	Becoming a digital business means enabling workforce productivity through tools such as mobile, data, and AI.	To strategically improve workforce business processing.	Assesses leader's strategic ability to develop workforce digital skills to improve business reinvention.
TECHNOLOGIES	**Das Gupta (2011) Sia et al. (2016) Whitehurst (2015)**	**Extent to which leaders use emerging technologies to achieve his/her goals. Sia et al. (2016)**	**To enhance strategic technical capabilities.**	**Assesses transitioning technical capabilities.**
To enhance our strategic technical capabilities I include;			**To increase technical capabilities.**	**Assesses leader's possible strategic technical capabilities enhancement.**
Smart technologies to integrate our operations	Whitehurst (2015)	It's time to leverage smart technologies as an integrated part of business strategy.	To strategically enhance operations.	Assesses leader's strategic technical capabilities enhancing smart technologies integration into operations.
Intelligently connected digital ecosystems furr enable our business opportunities	Whitehurst (2015)	CEO understands digital opportunities and threats.	To strategically enable business opportunities.	Assesses leader's strategic technical capabilities that enhance digital ecosystem intelligent connections for business opportunities.
Corporate digital innovations to further transform our business	Whitehurst (2015)	Leaders have clearly defined digital strategies.	To strategically to transform business.	Assesses leader's strategic technical capabilities enhancing digital innovation for business transformation.
Smart digital technologies empower our workforce	Whitehurst (2015)	Leader supports business led smart digital technologies initiatives.	To strategically empower workforce.	Assesses leader's strategic technical capabilities enhancing and empower workforce through smart digital technologies.
Digital global cloud connectivities	Whitehurst (2015)	Leader provides access to technical capabilities for workforce collaboration through innovation.	To strategically increase cloud connectivities.	Assesses leader's strategic technical capabilities enhancing global cloud connectivities.

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Innovations to change our competitive landscape	DasGupta (2011)	Innovations in communications present new ways of distributing knowledge to shape collaboration.	To strategically change the competitive landscape.	Assesses leader's strategic technical capabilities enhancing changes to the competitive landscape through innovations.
DIGITAL TRANSFORMATION			To transition the digital.	
SKILLS	**Sia et al. (2016) Whitehurst (2015)**	**Extent to which leaders have opportunity to develop his/her talents and digital skills into the future. Whitehurst (2015)**	**To move into the future.**	**Assesses skills development into the future.**
As a Digital Leader into the future, I can;			**To demonstrate ability.**	**Assesses digital leader's skills moving forward.**
Demonstrate knowledge of digital infrastructure costs	Whitehurst (2015)	Leaders must learn and stay abreast of digital trends.	To demonstrate knowledge of infrastructure costs.	Assesses digital leader's knowledge of transitioning digital infrastructure costs for transitioning the future.
Demonstrate knowledge of digital infrastructure and its use	Whitehurst (2015)	Leaders must learn digital trends and understand how to leverage new technologies.	To demonstrate knowledge of infrastructure usage.	Assesses digital leader's knowledge of transitioning the future with digital infrastructure and usage.
Apply technologies that identify, track, and mine our corporate data	Whitehurst (2015)	Leaders confident right level of technology knowledge and skills to succeed in their job as business becomes more digital.	To demonstrate ability to identify, track, and mine corporate data.	Assesses digital leader's ability to transition the future through applying technologies that may identify, track, and mine corporate data in the future.
Implement effective corporate business technologies	Sia et al. (2016)	Adapting workforce to digital is slower than adapting technology.	To demonstrate ability to implement business technologies.	Assesses digital leaders future ability to implement effective corporate business technologies.
STRATEGIES	**DasGupta (2011) Whitehurst (2015)**	**Extent to which leaders develop his/her digital**	**To achieve financial priorities.**	**Assesses strategies around financial priorities**

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		corporate strategies from a financial priority's perspective.		
As a corporate leader, strategic financial priorities I include are;			**To strategically budget.**	**Assesses leaders' strategic financial priorities**
Digital platforms to transform business value chains into value networks	Whitehurst (2015)	Digital business strategies have ability to increase product and service delivery speeds.	To strategically budget for digital platforms.	Assesses leader's strategic financial priorities for transforming business value chains into value networks through digital platforms.
Big data analytics capabilities	Whitehurst (2015)	Big data and analytics: insights into initiatives and strategies driving data investments.	To strategically budget for building big data capabilities.	Assesses leader's strategic financial priorities for using and developing big data analytics capabilities.
Interconnected digital technologies platforms	DasGupta (2011)	Connecting metrics and analytics enables better understanding of the network.	To strategically budget for interconnecting digital platforms.	Assesses leaders' strategic financial priorities for developing interconnecting digital technologies platforms
Future investment into digital operations	Whitehurst (2015)	Developing new digital business/ revenue streams.	To strategically budget for future digital operations.	Assesses leader's strategic financial priorities for budgeting future investment into digital operations.
Digital business transformations	Whitehurst (2015)	Transition to a digital first business model has been more cautious and methodical.	To strategically budget for digital business transformations.	Assesses leader's strategic financial priorities for budgeting for digital business transformations.

APPENDIX D – List of Related Publications

Hamilton, J.R., Tee, S. & Prince, K. (2016). Corporate Leadership in the Digital Age. In conference proceedings of the ICEB conference (2016), Xiamen, China.

Prince, K. (2017). Industrie 4.0 & Leadership. In conference proceedings of the ICEB conference (2017), Dubai, United Emirates.

Prince, K. (2018) Digital Transformation & Leadership. In conference proceedings of the APDSI conference (2018), Bangkok, Thailand.