Leadership Capabilities for Agile Organisations: Mining Leadership Frameworks Using Latent Dirichlet Allocation

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Abstract

In an effort to better translate practice in modern organisations into the academic research on capability-based leadership development, this study analysed leadership capability frameworks developed in the decade to 2015 by six Australian and New Zealand public and private organisations seeking to enhance their agility and responsiveness. Using the Latent Dirichlet Allocation (LDA) technique, analysis was undertaken on the textual construction of each organisation's unique leadership framework. Findings isolated 12 core leadership capabilities and five broad clusters or themes. Of further interest was evidence that machine learning could leverage findings from this study to analyse and predict the effectiveness other leadership capability frameworks.

Keywords: Capability, leadership capability, Latent Dirichlet Allocation, machine learning, agility, leadership development.

1. Introduction

Two pervasive fears guide leadership development in business today. First, that the leaders needed to support their existing business, workforce and strategic purpose are not being developed in sufficient numbers, and second, that even when leaders are being developed for existing needs, they may lack the capabilities required for the future (Phillips, et. al., 2016). Another issue is now adding to these challenges: the gap between current and future leadership needs is expanding, driven by the increasingly dynamic and competitive nature of the modern business environment. The result has been a growing discontinuity between the organisational investment in developing leaders that are technically capable, and accessing the talent required by the business to build a vision that will drive future success, engage and inspire a workforce, and rapidly respond to problems and opportunities (Deloitte, 2016; Feser, Mayol & Srinivasan, 2015; Straw, et. al., 2013; Paine, 2016).

Success for many businesses revolves around mastering not only their own people, processes and systems, but responding with increased agility and flexibility to megatrends impacting every organisation and employee. This includes identifying and seizing opportunities resulting from turbulent global markets, digital disruption, new business models, and changing workforce and customer demographics (Deloitte, 2016; CEDA, 2015). Central to future success is the presence of the right leaders with the right mix of capabilities for the right context.

In order to improve the development and supply of future leaders with the 'right' capabilities this study sought to answer the following questions:

1. Can a heterogeneous view of the categories or topics be derived from a study of contemporary leadership capability frameworks developed for Australian and New Zealand organisations focused on agility and customer responsiveness?
2. What are the core leadership capabilities being sought by organisations?
3. Can a set of reliable and valid descriptors for core leadership capabilities be used to analyse and predict the effectiveness of other leadership frameworks?

2. Leadership capabilities

Today as much as over the last several decades the research, literature and an endless array of experts continue the search to improve leadership. While some amazing strides have been made, the relevance and suitability of any one approach seems to have been called into question as the array of approaches and recipes for successfully developing leaders seem to abound as much today as they did two decades ago. While investment in leadership development has a proven impact on raising organisational performance and socio-economic advantage for a region, the full potential of a capability-based approach to leadership development only started to transition from business practice into academic research early this century (Burgoyne, Hirsh & Williams, 2004). This is despite the fact organisations in Australia and New Zealand had been using the approach since the early 1990s (Bowles & Baker, 1998). The cause for this lag seems to reside in two factors: avoidance of the field by academics who perceived leadership as a field that was both overhyped and full of spurious recipes for success that were resulting in too many failed leadership development programmes (Paine, 2016), and secondly, unlike generic skills or competency frameworks where a 'one-size fits all' approach can be used across organisations, a successful capability-based leadership programme had to be contextually relevant to each organisation, their customers and those being led (Hamel & Prahalad, 1998; Hamel, 2003).

Charles M Savage made a sage prediction when he stated the "basis of wealth is shifting from that which is 'possessed as a commodity' to the value of human capability" (1996, p. 12). While often overlooked, this statement predicted the digital economy or the so-called Industry 4.0 (fourth machine age). The human capital value of an individual isn't just their professional or technical competence to do a job; it is about their motivation, and their ability to adapt and to work in a specific context and cultural setting. It is as much about their potential to effectively adapt and grow their capabilities to meet changing needs as it is about current job performance.
It is important to establish that leadership capabilities extend beyond the typical coverage ascribed to competencies. A capability is the specification of:

…skills, knowledge, attributes, and personal experience that can be applied to a standard expected in professional practice at a given level of proficiency. It is concerned with the holistic view of an individual's ability to perform in a range of contexts and their potential to improve (Bowles & Lanyon, 2016).
In a leadership context, the primary differences between a capability and a competency centre upon recognition that:

- Beyond their technical skills and knowledge, leaders need to pro-actively transform and align individual behaviours and motivators to the agreed collective culture and purpose;
- Leadership capabilities are contextual to the culture, values and acceptable behaviours embedded in each organisation;
- Measuring capability goes beyond role performance to also evaluate employee satisfaction and alignment to both culture and purpose;
- The value of an organisation's human capital must be measured beyond current job performance to account for future potential.

Competencies define the skills and knowledge a person can deploy to competently perform. The original intention of authors such as McClelland (1973), Mintzberg (1973), and Boyatzis (1982) when they respectively established contingency and competency frameworks was to examine how to identify the underlying characteristics, skills, and knowledge that defined individuals able to best perform in specific functions or job roles. Behavioural approaches frame a competence as an underlying characteristic of a person that predicts superior performance (Raven, 2001; Spencer & Spencer 1993:15).

The definitional line between behavioural competencies and capabilities has always been very blurred. Boyatzis for instance suggests "A competency is defined as a capability or ability." (Boyatzis, 2008 p.6).

While this perspective is deeply enshrined in the behavioural approach driven by American scholars, it is not a universal view.

In other countries with national training frameworks (i.e. UK, Australia, New Zealand, South Africa, Malaysia, etc.), a competency isn't a behavioural descriptor; it is focussed on framing a technical, job-specific standard of performance. While behaviours may be linked or influenced by the competency standards, the competency descriptors relate not to the person, context, or job, but to the standard required at a level of employment. National competency frameworks in Australia and New Zealand, for instance, centre on the broad specification of the skills, knowledge, and attributes required performing particular tasks and duties, and the standard of performance expected in the workplace. They only obliquely consider the contextual variables and underlying characteristics that may influence deployment of the competency by an individual in a specific context (Bowles, 1999, p. 29). For many larger employers this agenda seemed to conflict with the development of organisational competency frameworks. These models were mainly tied to the organisations' competitive advantages, and their drive to change through learning and the improvement of both process and people capabilities (Prahalad & Hamel, 1990; Van der Bent, et al., 1999:379). These frameworks considered both task related explicit competencies that can be codified and learnt, and tacit knowledge associated with characteristics such as judgement, emotional engagement and thinking that were required to develop an engaged workforce that can perform, create and innovate (Dreyfus & Dreyfus, 1980; Robinson & Stern, 1997:89). Nowhere was this approach more important than in leadership development. Organisational capability was only enhanced where leaders' competencies encompass interpersonal, cognitive and personal attributes that extend well beyond the technical and role specific performance.

While organisational competency frameworks have evolved to parallel the focus of capability frameworks on capacity necessary to operate successfully with others to provide the people capability required to achieve agreed business outcomes. Ultimately, capabilities are differentiated from technical or job-specific competencies because they are about the talent and potential capacity to perform in a given context and to rapidly transfer that capability and replicate performance in a range of other roles or employment contexts. Transferability is not by measured within the job role or occupation, but through the contribution to the organisation's essential processes and contextual needs (Stalk, et al, 1992).

Some Australian organisations have been developing and implementing organisational leadership capability frameworks for over 20 years. While many of these evolved from the organisational competency approach, at least two of Australia's largest employers deliberately adopted strategies that were grounded in agile and dynamic capability theories (Bowles & Baker, 1998). These frameworks extended beyond occupational and technical competencies to focus on building competitive advantage through dynamic capabilities that provided the workforce scaffolding required supporting the organisation's future success. They aimed to develop the strategic, and cross functional leadership capabilities required to achieve successful organisational transformation (Kotter, 1995; Bass & Avolio, 1990; Stalk, et al., 1992; Conger, 1992). But the new ways of thinking and working inspired by capabilities were being advanced at an enterprise level, very much in isolation from national agendas focussed on enhancing job competencies at an industry level (Redding & Catalanello, 1994; Roth, 1996). As the broad industry competency focus intensified, so many of Australia's larger companies came to the realisation that publicly funded training systems were actively constraining their ability to remain competitive, agile, and strategically transformative (Bowles, 1997, p. 2). As organisations became aware of the fact they would continue to operate in increasingly turbulent and dynamic environments, they shifted their focus towards developing their own capability frameworks. These frameworks increasingly became more tightly interwoven with return on investment and human capital measures underpinning organisational agility and customer satisfaction (Teece, 2007; Teece, 2009; McCann & Selsky, 2012).

It is this type of leadership capability framework that is the subject of this study.

3. Methodology

The core of this research was an investigation of common language, clusters, groupings, and related definitions of capabilities used by organisations within leadership capability frameworks developed for their unique needs. The aim was to build a systematic understanding of similarities, and establish a set of common foundation capabilities that best represented them. To do this we applied a data mining approach.

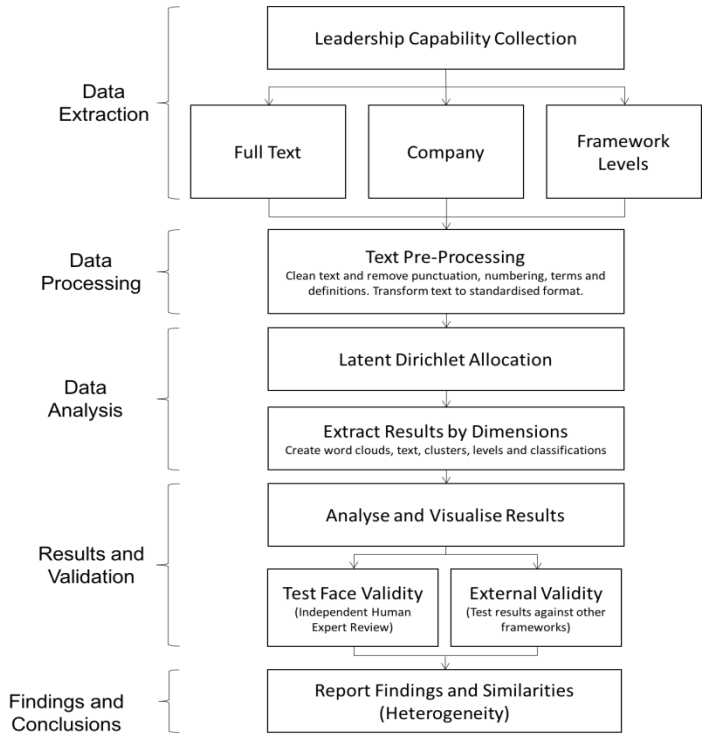


Figure 1: Representation of research design to extract latent dimensions based on Suominen, et. al., (2016).

A Latent Dirichlet Allocation (LDA) analytical technique was used, as it is an accepted and available methodology used mainly to extract semantic content from a collection of text documents. It has been among the most successful text analysis models developed within recent machine learning algorithms (Newman, et. al. 2009). With foundations in the development of search engine categorisation, and semantic prediction, it can effectively analyse even the most disaggregated or sparse data (Ihler & Newman, 2012; & Blei, et al. 2003). The process was conducted following reliable and valid methods used in other contemporary studies in related fields (Tellis & Johnson, 2007; Guo, et al. 2016; Suominen, et al. 2016). The LDA algorithm begins by identifying a random block of key words and phrases within the input text, and then performs repeated simultaneous iterations to the rest of the text inputs to identify words and phrases that co-appear in the text samples with the greatest frequency. The process typically follows a Gibbs sampling method, which simultaneously approximates high frequencies of sequences of observations (words/ phrases) at random (Newman, et. al. 2009; Ihler & Newman, 2012). Through this random and iterative process, it aggregates items based on similar semantic content. This effectively creates a probability distribution based on the likelihood of each term appearing in one of the topics. It has the ability to group or cluster them into a user-defined number of topics (Ihler & Newman, 2012). Thus, the results from each sequence are combined, and the end result is a number of topics (semantic groupings) which are defined by key words and weights (Ihler & Newman, 2012; Newman, et. al., 2009). In this paper, the LDA method was applied to identify frequencies of phrases and key semantic fields from 6 primary leadership and management capability frameworks. As an additional process, researchers undertook a comparative analysis for face validity of the LDA analysis results against additional leadership capability frameworks. All of the frameworks were developed for public and private sector business contexts as templates for required leadership and management capabilities – for the businesses to be agile and high performing. The Knime Analytics Platform (information available at www.knime.com), an enterprise-grade analytics platform for data mining was used to execute the LDA analysis.

3.1 Data

Six organisations and the frameworks used as inputs in the initial analysis include:

1. Working Futures™ (Generic Transformational Leadership Capabilities, The LEAD Framework, edition 2, 2007)
2. SANTOS Ltd (Integrated Leadership Capability Framework, 2009)
3. Canterbury District Health Board (Transformational Leadership Capability Framework, 2012)

4. Optus Ltd (Leadership Capability Framework, 2013)
5. New South Wales Public Sector (NSW Public Sector Capability Framework, 2014)
6. REST Superannuation (Revised organisational REST Competency Framework, 2015)

Five other frameworks were used to test and calibrate the reliability of the findings:

a) Qantas (Common Skills and Leadership Capability Framework 2007)
b) Woolworths (Leadership Competency Framework, 1998)
c) Commonwealth Bank of Australia (CBA Competency Framework 2005)
d) Newcrest Mining Ltd. (Leadership Capabilities, 2011)
e) Australian Public Sector (Senior Executive Leadership Capability framework, 2014)

These later frameworks were used in the analysis to test whether findings could be applied to an audit of other capability frameworks to confirm the frequency and use of the leadership capabilities identified through LDA in the original 6 frameworks.

The data being analysed represented five major organisations with over 4006 indicators spanning 4 to 7 different levels of proficiency. To assist the comparison process, these indicators were aligned into a standardised set of 5 indicator levels, as indicated in the Table 1 below.

Table 1: Total number of indicators by Standardised allocation of levels

Model	**Number of Levels**	**Standardised Allocation of Levels**				
		1	**2**	**3**	**4**	**5**
REST	4	1	2		3	4
NSWPS	5	1	2	3	4	5
SANTOS	5	1	2	3	4	5
OPTUS	7	1	2,3	4	5,6	7
CDHB	7	1	2,3	4	5,6	7
GTLCF	7	1	2,3	4	5,6	7
Total number of indicators in each standardised level:	(Total: 3922 indicators)	654	1068	516	1006	678
Capability descriptions:	84	*These describe sets of indicators, and include additional explanation of leadership and management themes covered*				
Total Items	4006					

To ensure the full range of relevant text from each framework was analysed, short capability descriptions were also included in the data set. Where these descriptions existed in a framework, they provided important supporting explanations for groups of capability indicators. A total of 84 capability descriptions were included in the data set, giving a total of 4006 items that were analysed using the LDA process.

While confidential in nature, the data used in this activity relied on access to the full capability frameworks, right down to the assessment criteria or behaviourally anchored rating scales used at each level of capability or organisational competency. A number of features were required for a framework to be included in this study. These included that:

a) Capabilities or competency standards in the frameworks were uniquely developed for that organisation (i.e. aligned to their values or context and not 'generic' to multiple organisations).
b) Frameworks describe key attributes associated with the acquisition and progressive development of leadership capabilities across different levels of work and learning.
c) Capabilities were not limited in scope to any one profession, occupation or job role.
d) They were developed by an organisation principally operating in Australia or New Zealand (even if they have international operations or are owned by a multinational entity).

In addition, the set of frameworks was chosen to provide broad coverage of the economy through inclusion of frameworks from public and private organisations operating in a range of different industry sectors.

All private sector entities selected would be considered medium to large employers. In terms of numbers in the leadership development pipeline, the smallest businesses had 48 leaders and the largest had over 2,000 identified leaders.

3.2 Procedure

Following Newman, et. al. (2009), the LDA procedure adopted in this paper began with 4006 individual leadership and management capability indicators from the main frameworks previously discussed. Indicators spanned across what would be expected of low of level young professionals, to capabilities typical of experienced executives and directors. This way the results inherently possessed the flexibility to be relevant for a number of different types of situations and individuals. Word groupings were based on common semantic fields that appeared most frequently across the frameworks, suggesting that those fields were most relevant to leadership capabilities. Groupings were limited to a maximum of 20 topics, each numbered 1 – 20. Each contained a series of key words weighted by frequency and relevance. Greater weights indicated by the LDA analysis meant that the term appeared in the greatest number of inputs, and subsequently was used more frequently to define a desirable leadership capability. This output was analysed further to identify key themes across and within the topics that were generated. The objective of the analysis was to establish commonalities within, and emphasis on particular capabilities that were frequently addressed in the LDA output. This was necessary to address the objectives of this research in identifying core dimensions of leadership capabilities, and to isolate 12 primary leadership capabilities. The 12 capabilities identified were consistent with leadership capabilities identified as critical to future success within Australian organisations, and as indicators of agile and high performance workplaces (Hull & Read, 2003; Bowles, 2015). Additionally, many of these capabilities were consistent with existing definitions of 'transformational leadership' (Kareem, 2016).

4. Results

As mentioned, indicators and capability descriptions were automatically aggregated into a number of "Topic Clusters". Based on their score in terms of key words and weights, each item (in this case capability indicators and descriptions) was allocated to one topic as shown in Table 1.

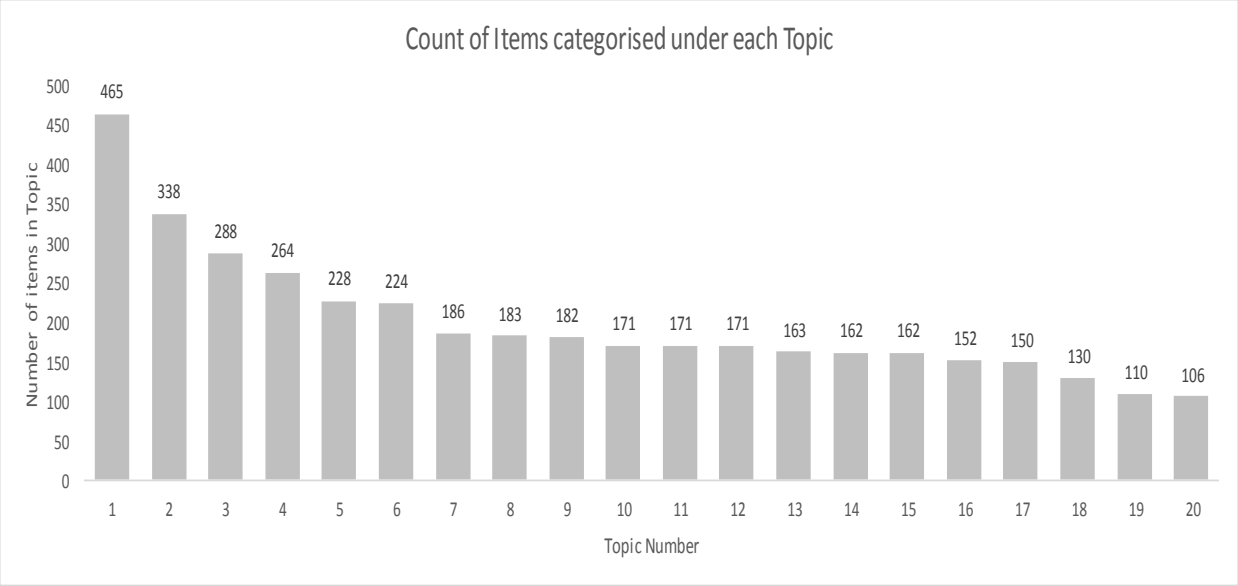


Figure 2: Count of items categorised under each Topic Number

Table 2: Keywords by Topic Number

Topic Number	Topic Keyword List
1	systems, processes, management, change, effective, planning, establishes, practices, risk, development, quality, ensure, solutions, health, safety, organisation, implement, business, project, governance
2	outcomes, achieve, resources, results, goals, plans, objectives, ensure, change, manages, business, team, required, term, activities, priorities, organisational, future, planned, operational
3	plans, change, vision, strategic, strategy, initiatives, organisational, business, communicates, develops, organisation, organisation's, purpose, stakeholders, major, support, objectives, brand, long-term, strategies
4	issues, stakeholders, actively, seeks, feedback, key, effectively, encourages, information, external, sources, identify, seek, advice, range, decisions, critical, internal, engage, respond
5	project, monitors, risk, reports, progress, plans, risks, appropriate, strategic, reviews, management, activities, manages, projects, change, controls, provides, targets, scope, organisational
6	requirements, compliance, knowledge, relevant, regulatory, policies, demonstrates, applies, standards, procedures, ensure, understanding, governance, company, legislation, organisation, understands, rules, audit, processes
7	data, demonstrates, knowledge, analysis, financial, understanding, research, applies, management, techniques, tools, information, basic, technology, business, skills, solutions, undertakes, based, communication
8	values, culture, ethical, organisation, organisation's, understands, act, behaviour, professional, consistent, beliefs, integrity, role, diversity, standards, model, promote, vision, manner, acts
9	change, goals, commitment, barriers, team, purpose, achieve, engages, conflict, leaders, removes, senior, strategic, stakeholders, ability, organisation's, attainment, resolves, accountable, agreed
10	performance, team, standards, feedback, individual, development, targets, establishes, capability, develop, analyses, sales, required, sets, identifies, actions, goals, data, recognise, specific
11	relationships, builds, organisation, external, opportunities, complex, key, support, internal, stakeholders, events, network, maintains, stakeholder, mutually, multiple, analyses, global, processes, improvement
12	customer, opportunities, experience, service, improve, seeks, identifies, value, business, enhance, ensures, continually, action, performance, monitors, analyses, focus, identify, acts, services
13	business, services, products, manages, product, development, strategies, vendor, marketing, party, prepares, 3rd, partners, develops, sales, solutions, delivers, customer, presentations, documents
14	understanding, service, demonstrates, knowledge, industry, practices, organisation, commercial, changes, providers, investment, broad, delivery, applies, improvements, services, products, strong, superannuation, internal
15	situations, opportunities, identifies, situation, social, learning, embraces, political, displays, economic, range, challenges, manner, perspectives, differences, cultural, maintains, appreciates, context, sensitivity
16	own, personal, professional, improvement, continuous, team, drives, strategic, operational, understands, development, contributes, broad, goals, performance, level, takes, accountability, manner, context
17	impact, potential, personal, identifies, own, ideas, anticipates, assesses, innovations, career, leadership, professional, improvements, environment, business, development, future, develops, change, beyond
18	priorities, customer, plans, goals, sets, responds, activities, medium-term, meet, organisational, indicators, changing, respond, schedules, communicates, requirements, own, prioritises, adjusts, changes
19	thinking, ideas, strategic, organisation, research, practices, international, takes, market, support, current, decision, trends, national, industry, action, practice, makers, health, environment
20	information, teams, encourages, team, knowledge, supports, functions, audience, appropriate, sharing, management, learning, rewards, locations, innovation, share, shares, organises, empowers, individuals

While confidentiality and vastness of the data precludes publication in this article, keywords (capability indicators by organisation and level) and weightings were used to classify all text items belonging to each topic.

In order to test correlations, face validity was also undertaken to examine any coding or classification errors. Acting independently, two separate researchers manually sorted, classified and formed topics and keywords. Consistent with methods in similar studies, using humans to review face validity was undertaken to cross-validate how machine processing of data generated correlations and a coherent set of topics and associated keywords (Tellis & Johnson, 2007). We compared the coders' decisions with the dimensions derived in the automated analysis to qualitatively evaluate the reliability of the automated analysis. Face validity was broadly ascertained because consistency existed between the two human reviewers and the topics and broad sorting of keywords.

External validity was tested using two human analytics. The first was to test the results from the analysis of the original six leadership capability frameworks against five other frameworks.

This was done to examine, (a) face validity and to establish if the LDA results carried across to other comparative frameworks, and (b) to confirm if machine learning could be used in future to undertake a comparative or predictive analysis of other frameworks. The first confirmed a very strong correlation and face validity. This also established, as would be expected, national approaches focussed on occupational view of leadership competency standards (e.g. Australia's Business Services Training Packages or New Zealand Health Leadership Competencies), did not show significant coverage of core leadership capabilities. Comparative with the leadership capability frameworks developed at an organisational level, the most important capabilities simply were not being addressed. This provided a compelling basis to believe machine learning could be undertaken in future to automate not just the comparative analysis of other capability-based leadership frameworks, the analysis could rate and predict if any leadership frameworks were addressing core capabilities agile, customer and market responsive organisations seek.

To assist interpretation of the results, word clouds visualisations were produced for the most frequent keywords tagged by each topic (for example, see Figure 3 below). This same approach was applied to whole levels of indicators (see Figure 4), and to analysis on other dimensions captured in the analysis (e.g. organisation, level, topic).

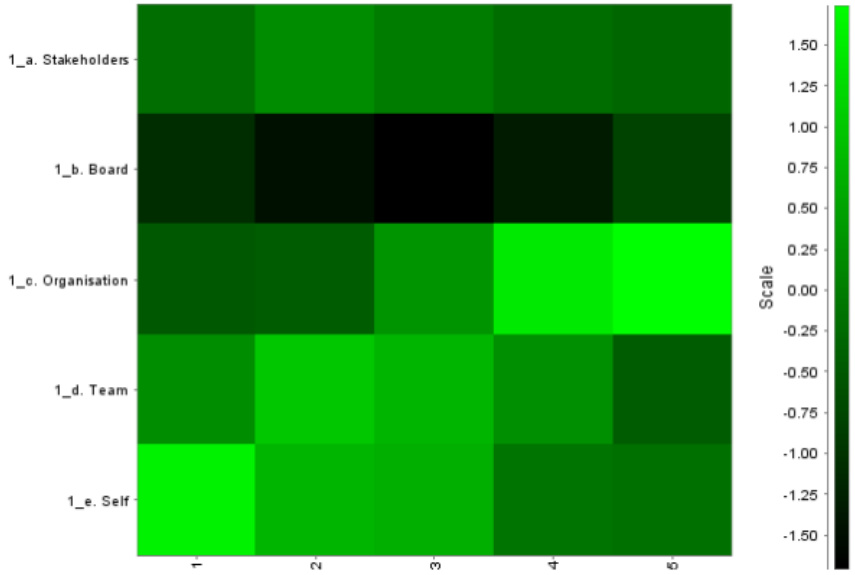
Figure 3: Topic 14 keyword cloud

Figure 4: Level 2 aggregated keyword cloud

The research also encompassed various work to explore the results, value and potential of the LDA analysis. For example, particular themes within the data were put into a secondary analysis process to produce visualisations such as the Heat Map below (Figure 6). This method was used to analyse the frequency of keyword sets (classifications or clusters) to analyse findings across the standardised indicator levels.

It was possible to then develop heat maps for a range of different leadership capability frameworks to indicate their comparability or consistency. For the process generating the heat map represented below, all of the data items were assessed for the presence of the selected keywords by level. This yielded a table of concepts and frequencies by level. These values were there put into Normalisation process (Gaussian Z-scale normalisation) to highlight any variations. The set of semantic fields were plotted against the standardised levels of ability (1 – 5) to determine the capabilities that were most frequently observed as per a given individual level of proficiency.

Figure 5 Frequency Heat Map



Sets of experimenter-selected keywords that related to different levels/groups within, and beyond an organisation were taken. All of the data items were assessed for the presence of the selected keywords by level, yielding a table of concepts and frequencies by level. The scale was normalised across the categories and levels following a Gaussian Z-scale normalisation process. Positive numbers (0 - 1.5) simply indicate greater prevalence of keywords in each group, where an increase in magnitude signals an increase in density. Figure 6 shows that self-related themes mainly related to level 1 individual, team or operational-related themes at levels 2/3, and organisation-related themes at levels 4/5. This validated the frequency of capabilities by levels of proficiency. This indicates that personal development and self-awareness were important capabilities for 'lower level' individuals (level 1). More skilled individuals in roles that consist of more responsibility, and require a greater degree of holistic organisational knowledge (levels 4-5) were aligned with capabilities related to strategic planning and organisational direction. It is clear that different capabilities are important at different organisational levels, and that leadership development retains relevance across most organisational settings. This will be important when organisations formulate personnel development programs, and employee empowerment practices. The capabilities that are targeted must be tailored to the individuals' skill levels and career objectives.

The greatest frequency of key words and topics produced by the LDA analysis emphasised a high degree of self-management, and second was effectively dealing and communicating with other groups and individuals. An initial indicator of significant leadership abilities were singular topic key words that featured most frequently across word clusters (topics) generated by the LDA analysis. Presented as root words, these were: organise (12), change (9), develop (9), manage (7), business (7), understand (6), identify (6), and plan (6). This was reinforced in Figure 3, where the number of total indicators present was highest in topic 1. Table 1 shows that many of these singular topic key words mentioned were evident in topic 1. Semantic insight was limited based on single word results, however these indicated that consistent word 'hits' were based on functional and proactive leadership activities. Particular emphasis was placed on the ability to 'change' and 'develop,' as well as functional elements such as planning and organising.

These featured strongly in the final set of capabilities that were established. The LDA results also identified exactly identical phrases that featured across multiple frameworks. To illustrate the significance of duplicate inputs, only 5 of 4006 indicators were duplicated exactly in at least 4 different frameworks in the LDA analysis, and only 35 were duplicated exactly 3 times.

This produced more definitive insight into key skills, knowledge, and abilities that are desirable in leaders beyond that produced by the LDA word clusters. Agility in responding to required changes, self-management in terms of an individual's own performance, and dealing with external conflict featured strongly. The text used for indicators that appeared identically across no less than four of the frameworks were:

- "Contributes own view", [typically in a confident or professional manner];
- "deals effectively with issues, problems and conflict";
- "Modifies strategy to respond to…" [external environment/ market changes];
- "perseveres when others quit"; and
- "Works well under pressure".

Frameworks that featured most in repeated indicators were GTLCF, REST, and CDHB. The LDA analysis produced emphasis on:

- The importance of flexibility, and willingness to change and adapt in response to external forces;
- Effectively dealing with others through collaborative approaches, strong communication skills, and the ability to resolve conflict; and
- The ability to plan effectively, and manage and organise one's self to achieve priority objectives in a timely manner.

Thorough analysis of the semantic groupings in each topic produced by the LDA analysis revealed striking consistencies across many clusters. Topics generally contained terms that emphasised the importance of conceptual understanding, and effective interpersonal dealing, however also produced some results in favour of technical abilities. Conceptual skills illustrated a holistic perspective of how activities such as relevant information collection, continuous improvement, and prioritisation of work, relationship management, goal setting, and strategic planning affected the direction of the organisation. These were relatable to essential skills highlighted in literature on global leadership (Matthews, 2016). Effective global leaders constantly adapted to complex and dynamic internal and external operating environments, in addition to having a strategic grasp on factors beyond the 'task environment' in the institutional view of business strategy (Matthews, 2016; Dalton & Ernst, 2004; Peng, *et. al.*, 2008). These were deemed essential to organisational performance, and were consistent with themes evident in the analysis thus far.

Beyond the strategic and conceptual leadership abilities outlined above, a trend of delegation of responsibility to subordinates and 'knowledge work' has emerged over the past three decades (Amundsen & Martinsen, 2015). Knowledge work is loosely defined as dynamic roles that incorporate inputs such as high level education and skills, continuous learning, and the use of information technology (Pyöriä, 2005). Given the link between empowering one's self and others, and positive outcomes for organisations and individuals (Seibert, *et. al.*, 2004), a deeper assessment of results concerning interpersonal capabilities such as empowerment, personal development, and communication was undertaken. Just over half of the exactly duplicated indicators from the LDA analysis that featured in exactly 3 different analytical frameworks were related to empowering people, educating one's self and others, and effective communication. Examples were:

- "Recognises and rewards entrepreneurial spirit amongst employees and leaders";
- "embraces learning as a lifelong activity"; and
- and "shares knowledge and skills with others".

These themes were strongly endorsed through emphasis on the recent development of knowledge work, and the role of transformational leadership in the learning organisation (Pyöriä, 2005; Kareem, 2016). Learning organisations are defined as "a place where people continually expand their capacity to create results they truly desire" (Kareem, 2016, p. 10). This justified the need for core leadership capabilities developed to include utilising and empowering the human capital at organisations' disposal to the best of their abilities.

Transformational leadership was characterised by individuals who support, coach, and engage others, develop others' potentials, resolve conflict and address issues effectively, and clearly communicate expectations and information (Kareem, 2016). The LDA results complemented existing empirical evidence of this empowerment yielding strong benefits (Blom, *et. al.*, 2002; Kuo & Low, 2001). Overarching themes that headlined many word clusters indicated important underlying inputs into developing effective interpersonal skills, and empowering individuals such as:

- Engaging other people to establish a commitment to the organisation's direction and future - Topics 1, 3, 9, 17 and 20.
- Promoting empowerment and learning through an environment open to discussion and communication - Topics 10 and 20.
- The ability to systematically and strategically manage relationships and situations - Topics 3, 4, 9, 11, 12, 14.

This suggests that effectively dealing with, empowering, developing, and understanding people are core leadership capabilities and fundamental avenues to organisational success. General evidence from the LDA analysis confirmed the importance of dynamic leaders with the ability to constantly update their knowledge to organisations. This is consistent with research that increasingly shows organisations open to learning are characterised by acceptance of change, agility, and the conscious effort to expand the capacity to influence and shape its future (Kareem, 2016). In 6 of 19 topics there was evidence for capabilities such as future orientation, willingness to change and innovate, and an emphasis on results and outcomes. Results from the LDA analysis and past literature produced conclusive evidence for leaders to not only possess compelling interpersonal abilities, but also an end-to-end view of the organisation's core processes and a holistic perspective of organisational direction and agility. As previously stated this was represented by consideration of the future in goal setting, the ability to collaborate with other parties, be flexible and effectively obtain resources while maintaining a strong emphasis on business outcomes (Teece, 2009; McCann & Selsky, 2012). These conclusions justified and shaped a core group of capabilities that were judged to be most important to leaders based on the results of the LDA analysis.

5. Findings

The use of LDA has allowed a consolidated insight into contemporary leadership capability frameworks developed for Australian and New Zealand organisations focused on agility and customer responsiveness. Moreover, compelling evidence exists to confirm a consolidated set of 12 key capabilities that were deemed to be critical indicators of future leadership potential in Australian organisations of all sizes. These were geared to have specific focus on agility and a high performance culture consistent with Bowles (2015), Hull and Read (2003), and Boedker & Cogin (2011).

Table 3: Most frequently identified leadership capabilities

#	'Field'	"Topics" Best Represented
1	Future Orientation and Vision	3, 7, 9, 16, 17, 18
2	Develop and Empower Others	9, 11, 16, 17, 18, 19, 20
3	Inspire and (Emotionally) Engage People	3, 9, 15, 17, 18, 20
4	Change and Innovation	7, 9, 12, 13, 18, 19
5	Integrity and Adherence to Standards	6, 8, 10, 14
6	Results Orientation	1, 2, 10, 12, 16, 18
7	Self-Awareness and Courage	11, 14, 15, 17
8	Critical Thinking	1, 2, 4, 11, 15, 18, 19
9	Collaboration and Influence	1, 2, 3, 4, 5, 20
10	Ethical and Cultural Awareness	8
11	Communication and Relationship Management	1, 3, 4, 9, 10, 11, 12, 13, 18, 20
12	Technical Mastery	5, 6, 7, 14

While not supported by importance or frequency in earlier leadership capability frameworks two other capabilities may be considered. They include 'Customer orientation' and 'Risk and governance'. It is also noted that one of the limitations of this study is that while the capabilities listed do reflect the data, it is also obvious that many organisations may merge or disaggregate some of the capabilities (e.g. 'Integrity and Adherence to Standards' with dimensions in 'Ethics', 'Cultural Awareness', 'Compliance' or even 'Governance'; or 'Creativity' and 'Innovation' may be separated). Ultimately the findings are an indication of capabilities that should be covered by leadership capability frameworks, not how they are framed by each organisation.

These capabilities provided a foundation for a case to move beyond traditional prescriptions of the 'how to' lead people within organisations.

Traditional frameworks of leadership and managerial skills or capabilities presented in past literature such as Waters (1980) and Spencer and Spencer (1993), provide generic categorisations of skill development that rigidly prescribe development of skills and behaviours. These frameworks are often narrow, and overlook broader transferrable abilities that can be applied in many contexts. Hence, indicator inputs in this paper were deliberately included to meet the criteria of broad transferability.

Development of modern leaders aims to "engage and inspire people, and build a culture that enhances the transformational capacity of the workforce" (Bowles, 2015, p. 1). This is illustrated in the 12 key capabilities highlighted above, which represent characteristics that capture a broader set of skills and underlying knowledge that can be applied to an array of contexts. They comprise of a mix of forward looking indicators – envisioning of what is possible, a drive to succeed, rational and pragmatic decision making, and agile responses to new information, emotional intelligence, and ability to collaborate and influence the actions and beliefs of others in a compelling way. They were found to be a critical set of capabilities required of high performing contemporary organisational leaders in the digital age. The notable element of these findings is the lack of a rigid prescriptive framework that dictates how individuals must behave, or be trained to behave within inflexibly defined job roles or preconceived ideas as to what leaders do without regard for context.

This study indicates significant grounds exist to use machine learning for analysis of capability frameworks, and that the core leadership capabilities identified in this study can be used to analyse and predict the effectiveness of other leadership frame works. It can also confirm, at even the broadest level, that leadership capabilities being sought by an organisation should address high level capability clusters or themes such as:

- self-awareness;
- interpersonal communication, collaboration and engagement;
- inspire and develop others;
- leadership of change and innovation; and
- The ability to think and act strategically.

These five themes presented encapsulate the 12 key capabilities found in the LDA results. This suggests that leadership capabilities span beyond those entwined with management or task level descriptors of what a leader does, and that those who perform strongly in the future will adopt capabilities that are transferrable and malleable to a range of job roles and contexts.

6. Discussion and Implications

The results imply that effective digital-age leaders must possess a mix of self-awareness, pragmatism, understanding of how to effectively deal with other people, and agility in their willingness response to outside factors. There is potential for the key capabilities identified in this paper to be part of a 'profile' that organisational member's build, where no prescribed formula or roadmap exists. The notion of 'how to lead' appears to be less effective than a practical toolkit of capabilities that permit agility and adaptation to a range of circumstances. These no longer fall under a rigid management framework. Generic and ill-defined education programs that miss the experience or skills required in a specific context are likely to be less effective (Bowles, 2015). Equally, organisations may also need to consider redesigning and gearing human resources — selection and recruitment, job design, performance management, learning and development, talent, and reward systems—to be able to identify, attract, grow and reward people with the desired capabilities. This relates to how the workforce is structured to not only optimise a leader's technical performance but to promote the capabilities that ensure leaders optimise the organisation's flexibility and agility (Bowles, 2015, p. 13).

7. Conclusion

We have known that organisations have increasingly invested in the development of capability frameworks and the learning and development of their leaders. What this study shows is that there is a strong correlation between core leadership capabilities across multiple organisations despite the fact the capability frameworks were developed by each organisation for their unique environmental, strategic, cultural, business or customer imperatives.

Data analysis of textual construction of each organisation's unique leadership framework was used to confirm the leadership capabilities that appear to be the most relevant to agile and responsive organisations.

Independent of the context, it is suggested a generalisable framework for core capabilities leaders required in more agile, responsive and flexible organisations can be derived from this quantitative study of multiple frameworks. The findings provide a basis for generalisability and foundations for the conduct of future research (Eisenhardt, 1989; Flyvbjerg, 2006) using machine learning approaches able to analyse, learn and predict the relevance of new leadership frameworks comparative to the existing frameworks studied.

8. References

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