Digital Leadership for Digital Transformation

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SHORT ABSTRACT: Digital transformations within organizations are helping such organizations to deliver services efficiently and at higher speed. Digital transformation requires a leader who can initiate the process, manage the process and even mobile resources to accomplish the process. Thus, this research studied the characteristics of digital leadership necessary to lead the digital transformation process within an organization.

ABSTRACT: In the current era, digital technology has been among the competitive criteria for most organizations. Organizations have digitally transformed their services with the intention of imrpoving service delivery and improve efficiency and even boost revenue. Such transformation requires a digital leader who can champion such digital transformation. A digital leader is expected to initiate the digital transformation process, manage the process and even mobilize funds for such process. Thus, a digital leader must have some characteristics and behaviors that can enable him to achieve the goal of digital transformation. This research specifically studied the characteristics of digital leadership and based on Exploratory Factor Analysis identified related characteristics (i.e. factors) that were grouped into roles. The EFA of 23 items produced 7 factors while all 23 items loaded successfully. 4 factors and 13 items were included into the Confirmatory Factor Analysis which provided better fit for the sample data. The validity check showed the the digital leadership construct somehow converges and the 4 factors were different from one another. The study findings can be used by organization management while searching or promoting digital leaders, also they can be used in setting criteria and guidelines for getting leaders. Further research is recommended by incorporating more attributes and large sample size and if possible to consider cultural aspect.

Keywords: Digital Leadership, Digital Transformation, Exploratory Factor Analysis, Confirmatory Factor Analysis, Convergent Validity, Discriminant Validity

1. Introduction

Currently, we are noticing how digital technologies have been widely integrated in different sectors and within every dimension of human life. The digitalization and digital transformation through digital technologies can potentially change almost every aspect of our modern society. Digital technologies are transforming dimensions and sectors such as communication, education, work, politics, culture, administration, businesses and science. These transformations result in fundamental changes to how services are delivered, businesses are operated and how values are delivered to customers. Institutions, companies and organizations have already faced with huge technological transformation and are even expecting more challenges in the near future (Petry, 2018). These transformations are essentially enabled by technologies such as novel delivery models (e.g., cloud computing), pervasive computing (e.g., Internet of Things, cyber-physical systems), mobile computing, social media, as well as new tools and methods to exploit data (e.g., business analytics, machine learning) (Heilig *et al.*, 2017).

A good number of factors are driving organisations to adopt digital transformation. The transformation is taking advantage of lower prices of both hardware and software and global network connectivity to adapt their business infrastructure to the new digital era (Bharadwaj *et al.*, 2013). Pressure from customers, employees, competitors is also a factor speeding up adoption of digital transformation by organizations (Westerman *et al.*, 2011). Due to affordable prices of

digital devices, many people have these modern digital devices. It is now common for customers to book for a flight ticket using their iPad, or to make online purchase using their mobile phone and credit cards. Thus, customer demands, expectations and behavior towards digital transformation are also pressing pressures to its adoption by organizations. Successful digital transformation helps companies and organizations to create values and remain competitive in the markets. Keen & Williams (2013) examined how extremely successful firms (i.e. ultrasuccesses) such as Amazon, Expedia, Google, and Facebook created value in the digital world and contrasted them with firms that were dominant but have lost ground (i.e. ultrafades) (e.g. Dell, RIM, Nokia). Other firms and organizations have strategies to expand their businesses globally and thus facilitate transforming global flows of goods, services, money, and people. Globalization increases competition, thus puts pressure to companies to go digital, to survive and attain competitive advantages (Sebastian *et al.*, 2017; Westerman, *et al.*, 2011). Digitalization of the society, government and business stimulates inclusive growth as it leads to inclusion, access and transformation of the public service (Manda & Backhouse, 2018). It can be argued that companies, organisations or firms that hesitate to adopt digitalization will miss the boat in digital business and are likely to be left trailing behind in the dust.

According to Rai *et al.* (2012), the digital technologies are reshaping traditional business strategy to enable work to be carried out across boundaries of time, distance, and function. By explaining how improvisational capabilities can help firms engage in competitive actions, Pavlou & El Sawy (2010) indicated how digital technologies also enable different forms of dynamic capabilities suitable for turbulent environment. Scholars have indicated the way digitalization has been implemented in various places and sectors. Susarla & Tan (2012) have indicated the way digital technologies are transforming the structure of social relationships in both the consumer and the enterprise space with social media and social networking. Koroleva & Aleksandrova (2016) have paid attention to issues of comprehensive tax administration modernization and improvement on the basis of using digital technologies. Nganyanyuka *et al.* (2017) have indicated how digital technologies can transform rural water supply services in Tanzania by helping in monitoring and reporting broken water points for maintenance and repair. In agricultural sector, digitalization has revolutionized extension services, offering more affordable, efficient and far-reaching coverage, thus improved decision making through informed choices in farming (Kizito *et al.*, 2019). Also, in the agri-food sector, digitalization promises to increase productivity and competitiveness and ensure a more sustainable use of resources and the knowledge it provides helps to optimize farm production processes, improve risk management, predict market trends and enhance strategic decision-making capabilities (Kosior, 2018). In higher education institutions, digitalization can be demonstrated in how education is delivered through e-learning systems, how funds are managed, how student and employees information are managed etc. Thus, with digital transformation, the boundaries are abridged to facilitate cross-border transactions and businesses, time is shortened and speed is increased in services deliveries.

But what is digital transformation? The term is linked to new development delivered through use of digital technologies. Scholars have defined the term differently and thus a clear definition is missing. This study adopts a definition by Gimpel *et al.* (2018) which can be considered to encompass several dimensions. Gimpel *et al.* (2018) considered digital transformation to refer to ability of an organizations to adapt and capitalize on digital technologies to change business models, improve existing work routines, explore new revenue streams, and ensure sustainable value creation. The definition signals that digital transformation encompasses the actor (organisation, firm, company, etc.), technology (i.e. digital), process (adoption of technology), and results (improve situation and revenue, ensure sustainability). It is usually implemented through

digitization, i.e. the networking of people and things and the convergence of the real and virtual worlds that is enabled by information and communication technology (Kagermann, 2015). The digital transformation involves transformations of key business operations and affects products and processes, as well as organizational structures and management concepts (Matt *et al.*, 2015). The combined effects of several digital innovations during digital transformation bring about novel actors, structures, practices, values, and beliefs that change, threaten, replace or complement existing rules of the game within organizations, ecosystems, industries or fields (Loebbecke & Picot, 2015). Hinings *et al*. (2018) argue that digital transformation marks a point where the combined effects of digital innovations lead to the emergence of new organizational forms, new institutional infrastructure, and new institutional building blocks.

In literature, most scholars have emphasized the overwhelming positive effects of digitalization, like improving service deliveries, encouraging team works and improving business revenue (Bharadwaj *et al*., 2013; Hinings *et al*., 2018; Kizito *et al*., 2019). Contemporary literature indicates that project failure is a major issue in digital transformation context (Kozak-Holland & Procter, 2020). Forbes reported that 84% of companies fail at digital transformation (Rogers, 2006) and a staggering 70% of digital transformations fail (Morgan, 2019). Examples of digital transformation failures are scant and under-reported for commercial reasons (Kozak-Holland & Procter, 2020). A few examples include Research in Motion (currently known as BlackBerry) (Kozak-Holland & Procter, 2020); Nokia, the world's dominant and pace-setting mobile-phone maker which missed the market and acquired by Microsoft (Surowiecki, 2013); and Kodak's downfall as a result of its leader's lack of foresight to understand the pace of change (Sainger, 2018). The failures can threat the organisations admiring to invest in digital transformation or those doing business in analog fashion. Digitally transforming an organization requires special attention and proper management as it is complex process involving people, technologies and processes. In an interconnected system like an organization, a change in one aspect, like social (e.g. leadership, culture), will affect changes in other parts, like technical (e.g. technology), as well as their interaction over time (Avolio *et al*., 2014). With this, digitalizing an organization requires a leader who acknowledges digital transformation as the fundamental, strategic paradigm shift while instilling a culture that supports the change while enabling the organization's overarching strategy (Hemerling *et al*., 2018). Thus, in digitalization, leadership is essential and the key to digital transformation is re-envisioning and driving change in how the company operates (Westerman *et al*., 2011). Westerman *et al*. (2011) insist that "that's a management and people challenge, not just a technology one".

2. Objective of the study

With digital development which considers digital technologies as the platform which mediates development (Heeks, 2016), characteristics and qualities of digital leaders need to be thoroughly examined. Thus, the objective of this research is to examine the characteristics of digital leaders which are necessary to lead the organization to digital transformation. The ultimate is to help organizations develop management and leadership capability in digital technologies to lead to digital development and development in general.

3. Digital Enterprise Transformation

A digital enterprise organization uses digital technology as a competitive advantage in its internal and external operations. The digital technology reshapes both the infrastructure and operations/processes of a digital enterprise. Different scholars are reporting dramatic digital changes in different sectors/contexts in recent years. In public sectors which are largely about service provision, use of digital technology may change how people interact with their workplaces

and their work objectives and perform their tasks, giving employees greater personal freedom and creativity at work, increasing productivity in organizations, and providing citizens with improved (self-)services (Hellsten & Pekkola, 2020; Parviainen *et al*., 2017). Scholars suggest that adoption of digitalization enhances the national economic growth and that countries that have achieved mass adoption of digital technologies by individuals, businesses, and governments have realized significant economic, social, and political benefits (El-Darwiche *et al*., 2012; Sabbagh *et al*., 2012; Xu, 2014). Digitization could have also social contributions and governance impacts (Sabbagh *et al*., 2012). In consumer industries value chain, digitalization has shifted power from brands to consumers and shifted value from traditional players to digital insurgents; new entrants have been able to create profitable services, such as payment processing, freight logistics and last-mile delivery (World Economic Forum, 2016). Westerman *et al*. (2012) and (World Economic Forum, 2016) have indicated that digital leaders outperform their peers; at macroeconomic level, digitalization results in job creation, innovation, and economic growth (El-Darwiche *et al*., 2012); and increases the efficiency of public service and administration (Deloitte Access Economics, 2015).

Purchase *et al*. (2011) considered enterprise transformation as a change, not just a routine change but a fundamental change, that substantially alters an organization's relationships with one or more key constituencies (e.g. customers, employees, suppliers, and investors). The transformation can involve new value propositions in terms of products and services, how these offerings are delivered and supported, and/or how the enterprise is organized to provide these offerings, and can also involve old value propositions provided in fundamentally new ways (Konno & Iijima, 2019; Rouse, 2005). The debate about digital technologies and their impact on organizations raised a very pertinent research field of digital enterprise transformation - a term referring to the changes that digital technologies bring about in organizational structures, processes, business models, and culture (Hess *et al*., 2016). It means transforming enterprise by using digital technologies and networks in activities within enterprise and with other partners on own ecosystem (Konno & Iijima, 2019). The transformation process itself is complex and chaotic in its nature and might indeed produce a radical departure from the current state and hence Liu *et al*. (2011) assimilated it to organizational transformation which can have a major structural and fundamental impact on an entire organization. The process itself transforms three key areas of an enterprise: customer experience, operational processes and business models (Westerman *et al*, 2014). Changes in digital technologies and their usage represent the key triggers for departures from current trajectories in digital enterprise transformations (Liu *et al*., 2011) and such transformation encounters some of the following challenges:

i)   Lack of a clear vision for a digital transformation journey
Organizations need to develop a clear vision of how they will meet their customers' digital needs, set objectives against that vision, and execute them as per the schedule and plan (Tiersky, 2017). Failure to clearly articulate what an organization wants in digital transformation, why and when is needed, may cause an organization not to digitally succeed or grow up. Tiersky (2017) assimilates an organizations initiating digitalization without a vision like one going on a road trip without a destination.

ii)   Organizational challenges
These pertain to the obstacles that need to be overcome to move from consolidated practices and standards to new ones (Maltese, 2018) as complicated administrative apparatuses might want to ensure the operational business traditionally hinders innovation (Wolf *et al*., 2018). As the transformation involves management, technical team and other members, some can stand on the disruptive side of digital transformation, because their responsibilities and processes might be

changed. Tiersky (2017) argues that transformation to some means uncertainty, a challenge to their role or identity, and, worst-case scenario, possibly the loss of a job and their family's security.

iii) Cultural Challenges

Younger workers seem more open to new technologies and thus favour digital transformation, while older workers have problems in understanding the consequences of digital transformation on their job security (Wolf *et al*., 2018). A successful digital transformation begins as a cultural transformation, thus when focusing on changing culture, expertise and management must understand how these changes/transformations impact the overall organization (Schmidt, 2019).

iv) Technical challenges to Lead Digitalization Initiatives and transformation

Initiating digital transformation requires a combination of talent and technology as it brings along its own myriad of technical challenges that need the right people on board. Challenges include the difficulties concerned with the identification of appropriate tools and supporting technologies (Maltese, 2018); and lack of expertise. Digital transformation should be made by ensuring that the digital technology is maintainable and scalable; autonomous and efficient; robust; and reliable (Maltese, 2018).

v) Resources for Digitalization

Shortage of resources and poor resource management planning can challenge the digital transformation process. Thus, clear analyses of the required and available resources need to be made to set the project in motion seamlessly. Transformation can only succeed in organizations if adequate resources are made available for it which includes both financial aspects as well as employees from different areas (including management) of the work (Wolf *et al*., 2018).

vi) Development of transformation team and management

As digital transformation affects a whole organization, a successful team should exhibit breadth across multiple disciplines - and depth in a few (Overby, 2019). Overby (2019) adds that effective digital teams have low attrition rates, are co-located near business users, and tend to include more experienced professionals, and that such team requires a different mindset and should think 'outside-in' rather than 'enterprise-out'. The digital development team is supposed to coordinate, prioritize, implement, and govern an enterprise's digital transformation.

vii) Data protection, Legal and security challenges

Digital transformation presents challenges with respect to privacy and data protection and thus it is necessary to establish security controls that will balance data access with data protection. To comply with Intellectual Property Rights, licensing, and privacy concerns and guarantee secure access to data, legal and security challenges need to be addressed (Maltese, 2018).

viii) User-related challenges

Maltese (2018) believes that one of the major risks to be managed is failing to meet user expectations, both in terms of functionalities offered and time of delivery, which may hinder the acceptance, adoption and usability of digital technology (Mukono & Tokosi, 2019). A core user-related challenge for the realization of digital transformation is to align and adapt digital technologies with the messy and differentiated nature of users' everyday lives at works. To mitigate this risk, Maltese (2018) proposed to ensure proper and constant communication with them and involve them in all stages of the work and periodically be informed about the progress.

The examples of challenges provided above prove that digital transformation is a complex process that needs to be managed by a competent leader, a digital leader. A simple analysis depicts digital leadership as a combination between digital culture, digital competence and leadership traits. Thus, the following section explores how different scholars have tackled the concept of Digital

leadership.

4. Digital leadership

Digital transformation in an evolving digital environment calls on organizations to operate at faster speed to explore new opportunities enabled by advanced digitalization. Organizations must focus to generate innovative ideas that create value for customers, design digital-enabled services quickly using advanced technologies and build organizational capability to deliver such services to meet customer expectations (Tanniru, 2018). This requires a leader with quick and right decision making who can influence other people's actions to induce desired and effective performance (De Waal *et al.*, 2016). The decision making, faster design and delivery of these digital services require agility within the information technology under the co-leadership of IT executives i.e. digital leader (Tanniru, 2018), with the central role in driving fast decision-making process and propelling the change (Li *et al.*, 2016).

Scholars have defined *digital leadership* differently based on digital technology and digitalization, innovative behavior, environment/context to which it is applied, and based on existing leadership styles and theories. Mihardjo & Sasmoko (2019) considered digital leadership to combine culture and competence of a leader to use digital technology to create value to the organization. De Waal *et al.* (2016) considered digital leadership as the accomplishment of a goal that relies on ICT through the direction of human assistants and uses of ICT. We adopt a definition by El Sawy *et al.* (2016) who defined digital leadership as *doing the right things for the strategic success of digitalization for the enterprise and its business ecosystem*. As per El Sawy *et al.* (2016), such definition indicates difference between leadership and management. Bennis (1989) argued that *Leadership* is about doing the right thing for the success of the organization, while *Management* is about doing the thing right.

5. Conceptualizing Digital Leadership

In conceptualizing, measuring, and investigating leadership, scholars have differed and have focused in different dimensions or contexts. Some scholars have focused on the leader to explain leadership; some have examined leadership from a relational, group, or follower-centered perspective; others have focused on examining leader traits versus behaviors; while others have drawn from the cognition and affect literatures to explicate leadership and its effects (Hernandez *et al.*, 2011). Attempts to classify leadership theories have focused into and emphasized the relations among different domains (Avolio, 2007). Hernandez *et al.* (2011) suggested that all leadership theories focus on two fundamental aspects of leadership: the locus i.e. source of leadership and mechanisms i.e. how leadership is transmitted. In traditional theories of leadership, the leader is viewed as the source of leadership, and how it is transmitted and measured is based on the styles or behaviors of that leader (Hernandez *et al.*, 2011). Hernandez *et al.* (2011) identified five loci of leadership (leader, follower, leader–follower dyad, collective, and context) and four mechanisms of leadership (traits, behaviors, cognition, and affect). Leadership involves influence and that influence resides in and emanates from interactions with others (Chiang & Birtch, 2013). Theories discussing leader–follower relationship emphasize that leadership arise from specific features of the relationship rather than from unique partners in the relationship while in collective locus, leadership is presumed to arise from the interconnected relationships of people within a specific group of individuals (Hernandez *et al.*, 2011). Johns (2006) described context as situational opportunities and constraints that affect the occurrence and meaning of organizational behavior and as per Hernandez *et al.* (2011), context is broad and includes multiple levels (i.e. can exist at the individual level (e.g., an employee's job design), the group level (e.g., the reward system of the group), the organizational level (e.g., organizational culture), and the societal level (e.g., national

cultural norms), as well as across these respective levels).

Scholars have also explored the underlying processes through which leaders influence followers' attitudes, behaviors, and motivation. The best leaders exhibit certain qualities that make them hugely successful that help to differentiate them from other individuals. Personal traits describe something that persons have or bring with them and cannot be learned from scratch, and capture the stable and enduring qualities and patterns of individuals' emotions, thoughts, and behaviors (Mischel & Shoda, 1995). Though personality traits imply consistency and stability and are helpfulness and important in explaining consistencies in ones' behavior (Diener & Lucas, 2018), Hernandez *et al.* (2011) explained that the mechanism of *behaviors* encompasses the types of behaviors that make leadership possible. People differ from one another on behaviors related to the trait (Diener & Lucas, 2018). Approaches to leadership that emphasize cognition focus on the thoughts and sense-making processes related to leadership while affect captures the emotions and moods involved in leadership (Hernandez *et al.*, 2011).

Sow & Aborbie (2018) have described digital Leadership as exertion of influence for adopting strategies for demonstrated digital transformation processes and Mihardjo & Sasmoko (2019) have noted that digital Leadership is a combination between digital culture and digital competence. The study of digital leadership can be considered as part of the study about leadership based upon the upper echelon theory where organization output can be predicted by manager characters (Hambrick & Mason, 1984). A study by Günzel-Jensen *et al.* (2018) on relationship between different leadership styles suggests that digital leadership relates transactional, transformational and empowering (authentic) leadership, along with innovative behavior. Zhu (2015) defines criteria of digital leadership to consist of five characteristics: thought, creative, global visionary, inquisitive and profound. It is expected that a digital leader should display a wide range of capabilities and thus digital leadership may be explored based on a combination of leadership approaches.

Sow & Aborbie (2018) accepts that digital transformation process of any large-scale organization requires different leadership styles and such transformation strategy necessitates the collaboration of leaders, resources, and teams to ensure for a successful implementation. Sia *et al.* (2016) suggest that, when led by its visionary CEO, digital leaders can invest heavily in technology as a competitive enabler and successfully undertake radical organizational changes which can pervade entire organization. This suggests that digital leadership relates to digital technologies, strategies and skills and have different attributes i.e. characteristics.

To summarize, the characteristics relevant to digital leadership are those that facilitate digital innovation and enable initiation and implementation of digital transformation within an organization while imparting knowledge and skills to subordinates. To accomplish all these, a digital leader is the one who can:

i) obtain exceptional commitment, trust and efforts from organizational members;
ii) convince the management and other organizational members of the digital transformation initiatives and that the organization can accomplish them;
iii) lead with vision and purpose relating to digital transformation and engage followers for achievement;
iv) inspire the organizational members that their efforts will lead to extraordinary digital transformation; and
v) persevere in the digital transformation paradigm despite the constraining resources and rapid changing digital technologies.

Based on the above ideas, digital leaders can encounter three important challenges in their undertakings. Firstly, the leader is required to contemplate the organizational working environment, possible with limited resources, with the aim of integrating digital technologies in services deliveries. Secondly, the leader is required to convince the organizational management and other workers that the integration of digital technologies in services deliveries will be possible with available resources and will help the organization to accomplish its objectives, vision and mission. The other challenge is how to mobilize resources sufficient to facilitate the digital transformation processes. These challenges are interdependent as initiatives of a digital leader need to be accepted by stakeholders so as resources can be released and directed to digital transformation.

The above conditions and the challenges the digital leader is expected to encounter provide the theoretical framework for the constructs of digital leadership. Based on the challenges and operating conditions, digital leader is expected to execute different roles to which we can associate his/her characteristics and behaviours. An effective digital leader requires a new way of operating, where conscious choices need to be made on priorities and areas of focus. Thus, this research will study the attributes (i.e. characteristics and behaviours) of digital leader that can facilitate digital transformation within an organization.

6. Methodology

This research uses a quantitative research design in studying the characteristics and behaviors that define the constructs of digital leadership. This involved a self-reported questionnaire completed by respondents drawn from some organizations in Tanzania. As much are yet to be written on digital leadership characteristics, a thorough literature survey and exploration on measures of leadership effectiveness from the GLOBE survey (House *et al*., 1999) helped to assess the basic underlying attributes of a digital leader and compose the survey questions. We observed many characteristics in literature, but the choice of the characteristics by scholars lack logic and supporting theories. Thus, this study sought to categorize the characteristics and behaviors into different dimensions based on leadership roles. Targeted organizations were those with a high degree of digitalization, both public and private, those which have more than 20 employees and were founded five year prior to the survey. Targeted respondents were those in management, senior staff and normal employees. Digital leaders and their followers in their sections were also requested to volunteer in filling the questionnaire. The completed surveys were collected through physical visits and intensive contacting through telephone calling, email, professional social media (Facebook and WhatsApp), and personal networking.

7. Results

7.1. Respondents and Characteristics

A total of 212 respondents were involved in this study and were drawn from 4 universities, 2 media companies, 1 ministry, 1 insurance fund, 2 examinations councils and 4 regulatory authorizes. These organizations have a minimum of 50 employees and some have more than 500 employees. Most respondents were males 155(73.1%) and females were 57(26.9%). Majorities in the Universities volunteered in participating in the study as results 99(46.8%) had master's degree and 85(40.3%) had doctorate degree. Most respondents were in the age between 30 and 50 years i.e. 155(73.3%). Based on works experience, majorities (i.e. 117(55.4%)) have worked for more than 10 years in the same organization. Table 1 summarizes the characteristics of the respondents.

Majority of respondents were leaders (i.e. 116(54.7%)) and 124(58.3%) of respondents had attended leadership training. Majorities of leaders have been in leadership for 3 to 10 years (i.e.

84(72.3%)). Table 2 summarizes the leadership responses.

Table 1: Characteristics of Respondents

Gender			Education Level			Age			Work Experience		
Sex	T	T%	Education	T	T%	Range	T	T%	Years	T	T%
Female	57	26.9	Bachelor Degree	26	12.2	20 - 30	20	9.40	< 3 years	29	13.7
Male	155	73.1	Doctorate Degree	85	40.3	31 - 40	73	34.5	< 6 years	29	13.7
Total	212	100	Form Six	1	0.70	41 - 50	82	38.8	< 10 years	37	17.3
			Master's Degree	99	46.8	50 - 70	37	17.3	> 10 years	117	55.4
			Total	212	100	Total	212	100	Total	212	100

As majority of respondents had a minimum of bachelor degree, it is expected that they have a good knowledge of leadership and also can judge leaders perfectly. Based on age, majorities were above 30 years, and thus were matured and can make correct judgment of leadership assessments. Also, as most respondents were leaders, their leadership knowledge can facilitate correct assessment of leadership attributes.

Table 2: Leadership Characteristics

Whether a leader			Whether attended leadership training			Years of Leadership		
A leader	T	T%	Attended	T	T%	Years	T	T%
No	96	45.3	No	88	41.7	< 2	17	14.5
Yes	116	54.7	Yes	124	58.3	3 - 5	52	44.7
Total	212	100	Total	212	100	6 - 10	32	27.6
						11 - 20	12	10.5
						21 - 30	2	1.3
						> 31	2	1.3
						Total	116	100

The respondents rated 26 attributes which can be used to describe the construct of digital leadership. Attributes were measure on a seven-point scale, ranging from 1 to 7 where *1 = greatly inhibits*, *2 = somewhat inhibits*, *3 = slightly inhibits*, *4 = has no impact*, *5 = contributes slightly*, *6 = contributes somewhat*, and *7 = contributes greatly*.

7.2. Analysis Results

Preliminary analyses involved examining the inter-correlation among leadership attributes to identify and remove variables which did not correlate with any other variables or correlated highly with other variables ($r>0.90$). The correlation analysis resulted into dropping three variables due to poor correlation (Focuses on achieving results, Eager to know or learn something, and Integrates people or things into cohesive, working whole). This was followed by exploratory factor analysis (EFA), then the confirmatory factor analysis (CFA) and lastly validity analysis.

7.2.1. Exploratory Factor Analysis

The EFA yielded 7 factors with eigenvalues greater than 1.0, which collectively accounted for 73.75% of the total variance. Also, the scree plot indicated that a 7 factor solution should be extracted. Again, the EFA was conducted which specified the extraction of 7 factors. Interestingly, the 7 factor solution explained the same percentage (i.e. 73.75%) of the total variance. Results showed that all variables were correctly correlated (i.e. no variable with low correlation or correlation > 0.9). Sampling adequacy was examined using the Kaiser-Meyer-Olkin (KMO) measure to assess the suitability of the data for EFA and was found to be 0.69 and KMO values for

Table 3: Factor structure and loadings of digital leadership items

Roles, Variables and Descriptions		Factors						
		1	**2**	**3**	**4**	**5**	**6**	**7**
Inspirational role								
Convincing	Unusually able to persuade others of his/her viewpoint	0.64						
Influence	Capacity to influence the organization, convince others to influence	0.57						
Enthusiastic	Demonstrates and imparts strong positive emotions for work	0.65						
Trustworthy	Deserves trust, can be believed and relied upon to keep his/her word	0.68						
Motivational	Stimulates others to put forth efforts above and beyond the call of duty and make personal sacrifices	0.68						
Openness	Willing to consider ideas and opinions that are new or different to his/her own	0.60						
Innovation role								
Anticipatory	Anticipates, attempts to forecast events, considers what will happen in the future		0.72					
Digital savvy	Prepared to meet emerging business challenges, anticipates and responds to new paradigms of competition, navigating complexity and leveraging on data and analytics to make decisions		0.71					
Risk taker	Willing to invest major resources in endeavors that do not have high probability of successful		0.70					
Confidence	Thinks positively about the future and is willing to take the risks necessary to achieve their personal and professional goals		0.40					
Diplomatic	Skilled at interpersonal relations, tactful, facilitating participation in decision making			0.55				
Absorbing uncertainty role								
Sensible	Based on or acting on good judgment and practical ideas or understanding				-0.53			
Communicative	Communicates with others frequently				-0.51			
Direction	Providing vision and purpose				-0.51			
Agile	Adapt to an ever-changing and uncertain environment				0.40			
Collaborative	Works jointly with others (i.e. management and followers)				0.63			
Lobbyist	Ability to network in order to lobby for both resources and stakeholder support				0.63			
Adaptation role								
Informed	Knowledgeable; aware of information					0.64		
Planning	Prioritize activities					0.73		
Decisive	Makes decisions firmly and quickly					0.38		
Inspirational	Inspires emotions, beliefs, values, and behaviors of others, inspires others to be motivated to work hard						-0.48	
Visionary role								
Visionary	Has a vision and imagination of the future							-0.62
Encouraging	Gives courage, confidence, or hope through reassuring and advising							-0.63

individual variables were > 0.50, confirming that EFA was appropriate for the data. Item communalities (except for one item) were greater than 0.50 indicating that the sample size was adequate. The EFA produced 7 factors for loading items, but two factors/components were loaded with one item each. We first checked how the model fitted the data. Six fit indices were used: the comparative fit index (CFI), the root mean square error of approximation (RMSEA), Tucker-Lewis index (TLI), the standardized root mean square residual (SRMR), the relative chi-square test, and Coefficient of determination (CD).

Table 4: Fit indices for the three CFA models

CFI	TLI	RMSEA [90% CI]	SRMR	CD	Relative $\chi 2$ ($\chi 2/df$)	$\chi 2$ (df)
0.979	0.971	0.052[0.029, 0.072]	0.041	1	1.57	87.893(56)

As per Hu & Bentler (1999), CFI and TLI are expected to be greater than or close to 0.95 to indicate acceptable fit, and SRMR should be less than 0.08 for acceptable fit. Browne & Cudeck (1992) argue that RMSEA value of 0.05 or less is considered a good fit, 0.08 indicates acceptable fit,Table 3 shows the EFA results indicating how attributes were grouped into digital leadership roles based on the factor loading. All items loaded appropriately as the minimum loading value was 0.3. Based on the loading factors, items were grouped into five roles. Items in the first factors appear to represent the inspirational role of digital leaders, items in the second factor represent the innovation role of digital leaders, items in the fourth factor represent the ability of digital leaders to absorb uncertainties, items in the fifth role represent the adaption role of the digital leader while the items in the seventh factor represent the visionary role of the digital leaders. The two factors (third, sixth) each with one item were not grouped into roles.

7.2.2. Confirmatory Factor Analysis

To conduct the CFA, only items with loading factor > 0.5 were selected. All items of the first and seventh roles, items with negative correlation in the fourth role and the first three items in the second role were included in the test. Items in the fifth role were not included after ignoring one item with loading < 0.5. Thus, after reducing some items to fit the model, a total of four factors/roles and 13 items formed a model to be tested by CFA. The CFA model was tested using maximum-likelihood estimation with robust standard errors (MLR) conducted in Stata and SPSS AMOS. MLR was used because it produces standard errors and a chi-square test statistic that are robust to deviations from normality.

We first checked how the model fitted the data. Six fit indices were used: the comparative fit index (CFI), the root mean square error of approximation (RMSEA), Tucker-Lewis index (TLI), the standardized root mean square residual (SRMR), the relative chi-square test, and Coefficient of determination (CD).

Table 4: Fit indices for the three CFA models

CFI	TLI	RMSEA [90% CI]	SRMR	CD	Relative $\chi 2$ ($\chi 2/df$)	$\chi 2$ (df)
0.979	0.971	0.052[0.029, 0.072]	0.041	1	1.57	87.893(56)

As per Hu & Bentler (1999), CFI and TLI are expected to be greater than or close to 0.95 to indicate acceptable fit, and SRMR should be less than 0.08 for acceptable fit. Browne & Cudeck (1992) argue that RMSEA value of 0.05 or less is considered a good fit, 0.08 indicates acceptable fit, and 0.10 or more a poor fit. Relative chi-square values of less than or equal to 2 are considered as good fit and values between 2 and 3 are considered acceptable fit (Schermelleh-Engel *et al.*, 2003). CD is represented as a value between 0.0 and 1.0 (Schermelleh-Engel *et al.*, 2003). A value of 1.0 indicates a perfect fit, and is thus a highly

reliable model for future forecasts, while a value of 0.0 would indicate that the calculation fails to accurately model the data at all (Schermelleh-Engel *et al.*, 2003).

Error! Not a valid bookmark self-reference. shows the fit indices for the CFA models. All indices indicate acceptable fit. The CD value indicated a perfect fit while the relative $\chi2$ value indicated good fit. Also, the value of RMSEA indicated good fit. Based on the fit indices, we can conclude that the CFA model provides a better fit for the data.

7.2.3. Exploring more the CFA Model Output

The output of the CFA model is presented in Table 5 and basically the columns are the same as those presented for regression models. The rows present the standardized factor loadings and intercepts. The last row lists the chi-squared value for the model, which is explained while fitting the model to the data. The standardized factor loadings listed in the *Coef.* column and the corresponding *p-values* listed in the *P>|z|* column are the most important information that can be explored. The *p-values* for all of the factor loadings are below the typical cutoff of .05, leading to the rejection of the null hypotheses that the factor loadings are equal to 0; hence, the factor loadings are statistically significant.

Table 5: Measurement model output

Standardized		Coef.	OIM Std. Err.	z	P>z	[95% Conf. Interval]	
Sensible <-							
	Absorb	1	(constrained)				
	_cons	5.797	0.063	92.05	0.000	5.674	5.921
Communicative <-							
	Absorb	0.826	0.073	11.3	0.000	0.683	0.969
	_cons	5.943	0.052	115.35	0.000	5.842	6.044
Direction <-							
	Absorb	0.723	0.069	10.52	0.000	0.588	0.858
	_cons	5.887	0.051	116.23	0.000	5.788	5.986
Convincing <-							
	Inspire	1	(constrained)				
	_cons	6.028	0.083	72.84	0.000	5.866	6.191
Influence <-							
	Inspire	0.710	0.055	12.85	0.000	0.602	0.818
	_cons	5.929	0.078	76.23	0.000	5.777	6.082
Enthusiastic <-							
	Inspire	1.035	0.099	10.47	0.000	0.841	1.228
	_cons	5.759	0.086	66.74	0.000	5.590	5.929
Trustworthy <-							
	Inspire	0.629	0.068	9.26	0.000	0.496	0.762
	_cons	6.061	0.068	89.06	0.000	5.928	6.195
Motivational <-							
	Inspire	0.405	0.078	5.18	0.000	0.252	0.558
	_cons	5.939	0.072	81.93	0.000	5.797	6.081
Anticipatory <-							
	Innovation	1	(constrained)				
	_cons	6.321	0.109	58.09	0.000	6.107	6.534
Digitalsavvy <-							
	Innovation	1.021	0.046	22.35	0.000	0.932	1.111
	_cons	5.920	0.118	50.34	0.000	5.689	6.150
Risktaker <-							
	Innovation	0.980	0.040	24.53	0.000	0.902	1.058
	_cons	6.241	0.109	57.21	0.000	6.027	6.454
Visionary <-							

Visionaries	1	(constrained)				
_cons	5.863	0.052	112.98	0.000	5.761	5.965
Encouraging <-						
Visionaries	1.251	0.269	4.65	0.000	0.724	1.778
_cons	5.816	0.050	115.57	0.000	5.717	5.915

LR test of model vs. saturated: chi2(56) = 87.89, Prob > chi2 = 0.0042

We get standardized factor loadings because the variances for some factors were set to 1 to scale the latent variable and for model identification. The standardized factor loading for the *Communicative* variable was 0.826, meaning that a one standard deviation increase in *Absorb* led to a 0.826 standard deviation increase in the response to the *Communicative* question. The strongest factor loading of the fourteen items was *Encouraging* with a value of 1.251, it was the measure of *Visionaries*. Each factor has its strongest factor which is its best measure and *Motivational* is the weakest factor loading with a value of 0.405.

The intercept for each item labeled *_cons* appears below each factor loading in the *Coef.* column. The intercepts are the predicted values of the items when their respective factors are 0 or its mean. The intercept for *Communicative* is 5.943, which means that when *Absorb* is at its mean, and then *Communicative* is predicted to be 5.943 on its scale from 1 to 7.

7.2.4. Validity of digital leadership model

Two types of validity were discussed: Convergent validity and Discriminant validity. Convergent validity is concerned with whether or not a set of items share a high proportion of common variance. For convergent validity, the following criteria suggested by (Hair *et al.*, 1998) apply: (1) factor loadings should be above 0.5, (2) average variance extracted (AVE) should reach 0.5 as a minimum, and (3) composite reliability (CR) should be above 0.6 – 0.7. Table 6 presents the results of both Convergent validity and Discriminant validity.

Table 6: Validity of the digital leadership construct

Latent Variables		SL	SSL	SQL	NI	AVE	SVE	CR	Discriminant Validity			
									1	2	3	4
	Inspire	0.849	0.721									
	Inspire	0.642	0.412									
	Inspire	0.843	0.711									
	Inspire	0.649	0.421									
1	Inspire	0.393	0.154	2.419	5	0.484	0.696	0.421	**0.696**			
	Innovation	0.947	0.897									
	Innovation	0.895	0.801									
2	Innovation	0.926	0.857	2.555	3	0.852	0.923	0.852	-0.066	**0.923**		
	Absorb	0.836	0.699									
	Absorb	0.844	0.712									
3	Absorb	0.752	0.566	1.977	3	0.659	0.812	0.659	0.042	0.059	**0.812**	
	Visionaries	0.678	0.460									
4	Visionaries	0.875	0.766	1.225	2	0.613	0.783	0.613	0.057	-0.016	0.423	**0.783**

SL - Standardized Loading, SSL - Square of Standardized Loadings, NI - Number of Indicators, AVE - Average Variance Extracted. SVE - Square Root of AVE, CR – Composite Reliability, SQL - Sum of Squared Standardized Loading

All the items have factor loadings (SL) above 0.6, except of one item with a value of 0.393.

Three factors have an AVE value above 0.5, one item has a values less than 0.5 (i.e. at 0.484), which upon approximation is still above the cut-off point of 0.5, thus they all show a good levels of internal consistency. Three values of CR are above 0.6 while one is less than 0.5. Based on these results, we can conclude that the measurement model *somehow* satisfied the criteria of convergent validity.

The discriminant validity is the extent to which a construct distinctly differentiates from others. Based on Fornell & Larcker (1981), we assess whether the four factors are different from one another by testing whether the square root of the AVE for any given two factors is greater than the correlation between these two factors. Results in Table 6 show such a case and thus we can conclude that four factors have distinctive properties that capture different aspects of roles of digital leadership.

8. Discussion

The aim of the present study was to explore the characteristics and behaviors of digital leaders necessary for successful digital transformation. Using the EFA, the 23 items were all loaded with the minimum value of 0.3 and seven factors were identified which were trimmed to five factors. Based on the EFA model, the items were grouped into five roles of digital leadership. Overall, we can argue that the EFA model fitted well the data.

Note all items and roles were included in the CFA model but only 13 items drawn from four different factors were included for analysis. The CFA model fitted well the research data. However, the CFA indicated the model somehow converges while the factors were different from each other.

The five roles of digital leadership identified from the EFA model have different interpretations. The digital leader is expected to execute different roles to which we can associate his/her characteristics and behaviors. An effective digital leader requires a new way of operating, where conscious choices need to be made on priorities and areas of focus.

The role of digital leadership to innovation is fundamental to digital transformation. Under increasing pressure to innovate, leaders need to undertake an active role in identifying the need for change, as well as handling, and initiating change within their teams and organizations (Schwarzmüller *et al.*, 2018). If it is true that the digital world forces leaders to examine problems and provide innovative answers at a faster peace, the use of information technology also allows them to make more informed decisions (Cortellazzo *et al.*, 2019).

In a work by Bennett & Lemoine (2014), the computing environment has been described as VUCA to reflect four distinct types of challenges that demand four distinct types of responses. VUCA represents Volatility (i.e. challenges are frequent and require strong changes); Uncertainty (i.e. lack of predictability); Complexity (i.e. interdependence of different elements); and Ambiguity (i.e. cause-and-effect confusion) (Bennett & Lemoine, 2014). In this situation, digital leaders are found to anticipate uncertainties and threats, calculate their moves on how to overcome them and whenever failure occurs, never give up but see it as a lesson learnt then move on. Also, digital leaders are keen to protect their followers from the vagaries of uncertainties and the paralysis that accompanies them. McGrath & MacMillan (2000) call this a role of absorbing uncertainty which is important for leaders to help their followers cope with uncertainty by taking personal responsibility for risk exposure, thus building their confidence enabling them to act as if it is possible to realize the vision.

Some scholars (e.g. Gardner *et al.*, 2010) have reported that digital transformation is perceived as

a threat to employees and to the current status quo. Based on Avolio *et al.* (2000), digital leadership can be considered as social influence process mediated by advanced information technology to produce a change in attitudes, feelings, thinking, behavior, and/or performance with individuals, groups, and/or organizations. In this respect, a digital leader has an inspirational role to employees about the benefits of digital transformation with tangible proof of concept, even if the successful experiments are small in scale.

Currently, in most complex networked organizations the traditional hierarchical leadership models don't work properly. Thus, digital leadership requires networking with every employee, and the use of influence and knowledge brokering. This requires digital leaders to reshape leadership roles and functions to adapt to the complex networked organizations. This helps digital leaders to build common understanding and agreement of what can or cannot be accomplished thereby enhancing he effectiveness of these networks. As per Petry (2018), leadership needs to be more networked, open, participative and agile.

With visionary role, it is generally argued that leader visions motivate followers by focusing on reaching desirable end-states by focusing on avoiding undesirable situations. Visions are often described as images of the future and should fit followers in order to be effective. It is critical importance that leaders engage their followers in innovation activities and thus tasks become much easier. McGrath & MacMillan (2000) proposed the digital leader to frame challenges that are within the limits of abilities of the followers and not overburden them. Westerman *et al*. (2014) proposed the digital leaders to address three areas early in the process: building awareness (i.e. ensure top leaders in the organization understand the potential threats and opportunities from digital technologies and the need for transformation); defining the starting point (i.e. leverage organizational existing resources and competencies in the new digital environment); and creating a shared vision (i.e. align organizational top leadership team around a vision of the organization's digital future). By crafting a digital transformative vision, the ultimate is that the team can align around this (vision), and together build awareness of digital opportunities and threats (Khan, 2016).

The five identified roles were used to study the construct of digital leadership ~~construct~~ by measuring the characteristics (i.e. attributes) of a digital leader necessary for successful digital transformation within the organization. The study used 23 characteristics (i.e. limited) and as a result two factors were each loaded with a single item and thus failed to be incorporated into the CFA model. Also, due to weak factor loading (<0.5), some items were not incorporated into the CFA model. Possible, more attributes and a large sample size can produce more factors explaining the roles of digital leadership.

Despite the lower number of items included, the CFA model fitted well the data. Though it was not included in the results, the single, two and three factors CFA model all fitted well the data. It can be generalized that the CFA model fitted well the data. To improve the validity, especially convergent validity, more items can be included in the CFA model with large sample size.

9. Conclusion and Recommendations

The study has explored how the construct of digital leadership can be explained based on leadership attributes and behaviors and associated roles. Both the EFA and CFA have proved their usefulness in modeling the attributes of digital leadership and assigning them to roles.

Through authentication and evidenced by the CFA and supported by validity tests, the normal leadership model is composed of aspects of the duties and responsibilities delegated to followers and team members, bringing membership to a consensus, influence others on the job, playing the

role of team leader, mentor others, motivate team members, making appropriate decisions, and lead effectively. Based on discussion above, expressing leadership aspects and playing the role of a leader to the followers are most needed by the employers. This is consistent with studies by Rollins (1998) who suggested that leaders have strong influence on the behavior and performance of the group.

The findings of this study can be used by organization management while assessing the characteristics, behavior and roles of leaders, especially digital leaders. The findings can help organizations develop their leadership module for identifying potential leaders effectively. In most organization where leaders are appointed, the findings of this study can assist the appointing committee to make best selection of leaders. Based on the study findings, organizations can create guidelines for appointing or searching leaders based on items in aspect of leadership and findings of this study.

However, the study has some recommendations and observations that can assist in future researches. Most respondents of this study were academicians based in higher learning institutions and also the study included more respondents from public organizations. Based on gender, males dominated the sample. This may somehow bias the results of the study. Thus, it is recommended that further study be conducted and consider respondents from both public and private sector, gender and education levels. Culture may also influence the way we judge leaders, thus a research can also incorporate a component of culture while performing such a study. A study of this nature may easily generalize its results across sectors, organizations and culture.

Also, the study recommends exploring more items that can explain the construct of digital leadership and incorporate them into the study. With a large sample size, the EFA can yield more factors with good factor loading and thus allow more items to be included into the CFA model for analysis.

Lastly, the study recommends digital leaders to adopt transformational leadership style. With this leadership style, digital leaders can inspire positive changes in their followers. Transformational leaders are generally energetic, enthusiastic, and passionate (Bass & Steidlmeier, 1999). Not only are these leaders concerned and involved in the process; they are also focused on helping every member of the group succeed as well. With the attributes of digital leaders identified with EFA, the transformational leadership style fits better to be adopted by digital leaders. As the digital transformational process requires team work, adoption of transformational leadership style can facilitate and encourage cooperation among digital leaders and their followers for the success of their works. The ultimate is the successful digital transformation with a happy team.

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