IEEE Access
Multidisciplinary | Rapid Review | Open Access Journal

Received November 5, 2019, accepted December 1, 2019, date of publication December 23, 2019, date of current version January 2, 2020.

Digital Object Identifier 10.1109/ACCESS.2019.2961678

The Ability of Project Managers to Implement Industry 4.0-Related Projects

ANNLIZÉ L. MARNEWICK[1] AND CARL MARNEWICK[2]

[1]Postgraduate School of Engineering Management, Faculty of Engineering and the Built Environment, University of Johannesburg, Johannesburg 2028, South Africa

[2]Department of Applied Information Systems, College of Business and Economics, University of Johannesburg, Johannesburg 2028, South Africa

Corresponding author: Carl Marnewick (cmarnewick@uj.ac.za)

ABSTRACT The 4th Industrial Revolution is challenging the ways we are working at all fronts. Its impact is felt in families, organisations and communities. The impact on organisations and particularly working environments is still largely an unknown. Part of the working environment entails the way project teams should be managed. Speed and agility are required to implement the various technologies that form the underlying basis of the 4th Industrial Revolution. This requires project teams and project managers to adjust their behaviour. This article focuses on the various leadership styles and those that are more appropriate for the implementation of these new technologies. A survey was conducted amongst South African project managers to determine their level of servant-leadership and 621 responses were analysed. The analysis focused on servant-leadership attributes. The results determined that five attributes of the servant-leadership style are important but that in general, South African project managers still focus on a 'command and control' type of leadership. The article contributes to the current debate on the best ways to manage project teams during the 4th Industrial Revolution. The jury is still out on the best working environment and the results indicate that a servant-leadership style is most appropriate but that project managers are not embracing this leadership style. This might have to do with training that they have had. Current project management best practices and competencies do not focus on this new way of working and organisations and project management bodies need to address this concern.

INDEX TERMS Agile software development, Industry 4.0, project management, servant-leadership.

I. INTRODUCTION

Shakespeare mentioned servant-leadership in Henry VI where the king stated that "*My crown is in my heart, not on my head; Not decked with diamonds and Indian stones, Nor to be seen. My crown is called content: A crown it is that seldom kings enjoy*" – Henry VI Pt. III Act III Scene I. The idea is that although Henry VI was the king, his purpose was to serve others for their benefit and not his own. This is the essence of servant-leadership, where the leader is there to serve others to the benefit of the organisation. Centuries later, servant-leadership is perceived as the best leadership style for the 4th Industrial Revolution [1], [2].

The foundation of the 4th Industrial Revolution is technologies which are implemented nowadays using Agile methodologies. Research highlights that servant-leadership is the best way to manage teams in an Agile environment. The problem is that little or no research has been done to determine whether South African project managers exhibit servant-leadership attributes. Various researchers have focused on the concept of servant-leadership and its relationship with other leadership styles, as well as what the underlying behaviours are of a servant-leader. These studies have been done outside the disciplines of project and information management technology. This article focuses specifically on the project management discipline and the readiness of project managers to implement 4th Industrial Revolution related technologies using a servant-leadership style.

Literature focusing on Agile as a mindset and various Agile methodologies mentions that servant-leadership is the preferred style. The literature fails to address the servant-leadership style, specifically its attributes and whether it aids project managers to manage Agile projects better. Project management literature is also quiet in this regard and simply

The associate editor coordinating the review of this manuscript and approving it for publication was Davide Aloini.

mentions that various leadership styles exist and that the project manager must decide which one is more appropriate. Given this background, the following research questions were posed:

1. Are South African project managers servant-leaders?
2. What are the most important attributes of servant-leadership that South African project managers exhibit?
3. How do South African project managers compare with other international studies?

The first section of the article focuses on the literature linking the concepts of Industry 4.0, the 4th Industrial Revolution, Agile and servant-leadership. This is followed by the research methodology and section 3 focuses on the analysis of the results. Sections 4 and 5 cover the discussion and conclusion sections.

II. LITERATURE REVIEW

A. INDUSTRY 4.0 AND THE FOURTH INDUSTRIAL REVOLUTION

The focus of Industry 4.0 is on cyber-physical systems (CPSs) and the Internet-of-Things (IOT) [3], as well as on the integration of various technologies that enable information technology ecosystems to function in an intelligent and autonomous way. This integration promotes autonomous decision-making (artificial intelligence), interoperability, agility, flexibility and efficiency [4]. The 4th Industrial Revolution emerged from Industry 4.0, which is seen as the main component of the 4th Industrial Revolution [5]. Perales *et al.* [4] are of the opinion that Industry 4.0 provides the roadmap that leads to the 4th Industrial Revolution.

Whereas the focus of Industry 4.0 is on the technical aspects, the focus of the 4th Industrial Revolution is on the impact that Industry 4.0 has on the environment at large, such as the way that projects will be managed and implemented. According to the World Economic Forum (2016, p. 30), the 4th Industrial Revolution ''represents a fundamental change in the way we live, work and relate to one another''. It is about more than just technology-driven change. The focus of the 4th Industrial Revolution is beyond Industry 4.0 technologies and on uncovering ways to give the greatest number of people the ability to positively impact their families, organisations and communities [6]. Pereira and Romero [7] believe that the impact will be felt in (i) industry, (ii) products and services, (iii) business models, (iv) the economy, (v) working environments and (vi) the development of skills. Sony and Naik [8] believe that there are six factors that influence the readiness of an organisation for the 4th Industrial Revolution, with the involvement and commitment of top management and the adaptability of employees being applicable to this article.

In this environment that is dictated by the 4th Industrial Revolution, the development and innovation periods need to be drastically shortened [9]. This paves the way for using Agile as a mindset to develop and implement innovations in a shortened period. Agile is also more successful in implementing products quicker and faster than the traditional waterfall method [10]. Liao *et al.* [11] have identified eight priorities that organisations need to address to fully embrace the impact of the 4th Industrial Revolution. One of these priorities is the way that work is organised and designed. The emphasis should be on a socio-technical approach that offers workers the opportunity to enjoy greater responsibility and enhance their personal development.

TABLE 1. Critical success factors for the 4th industrial revolution.

Attribute	Explanation	Study
Leadership	• In support of sustainability. • Leadership style capable of inspiring followers to overlook self-interest in favour of the greater good.	[1, 2]
Change	• The implementation of Industry 4.0 technologies implies organisational changes in many areas. • Organisations must be ready for change.	[1, 2, 13]
Organisational agility	• The organisational capability to embrace the uncertainty and respond to it through the effective application of structures, information systems and mindsets.	[12, 14]
Empowerment	• The environment must allow employees to develop the autonomy and responsibility in order to behave proactively.	[1, 15]
Collaboration and teamwork	• The digital reinvention requires business and technology implementors to work closer than ever before. This implies trust and communication within the collaborative environment.	[1, 2, 16]
Project management	• The integration of Industry 4.0 technologies requires the organisation of effective teams.	[1]

Various critical success factors that need to be considered by an organisation on the journey towards the 4th Industrial Revolution are discussed in literature [1], [2], [12]. Table 1 is a summary of these factors. This is in addition to the critical success factors of strategic alignment, top management commitment and new skills and capabilities.

It is suggested that the 4th Industrial Revolution is in process. This implies that there are still various unknowns, for example the required type of leadership style that is best suited to manage the journey. However, it is known that change will have to be managed and it should be done in an agile way. Studies indicate that top-performing teams are agile [17], implying that agile teams are capable of adjusting their thinking and are part of the decision-making process. Traditional hierarchical leadership styles are currently being replaced by leadership styles that create positive change through the transformation [18].

Digital technology implementation that goes hand-in-hand with Industry 4.0 will in most instances be the first time that teams implement these technologies. The implication is that project teams will have to continuously learn new technologies, resulting in new skills, competencies and lessons to be learned and mastered. It is suggested that for successful

implementation, a break is required from the more traditional project structures and that new and Agile project structures that enable communication, collaboration and social interaction will be key to deliver value.

The 4th Industrial Revolution is synonymous with change. During this transformation, specific individuals will influence the strategy, educate others and be part of the decision-making of project priorities [16]. Well-networked change agents will complement the leadership efforts by operationalising the vision and objectives.

To respond to the opportunities of the 4th Industrial Revolution, change needs to be embraced. This requires a different leadership style within the project environment from the traditional controlling role [19]. As noted by Parker [20], the principles of servant-leadership benefit the building of self-organised teams as they empower followers – this is noted as a critical success factor [21].

Table 2 summarises from literature how Agile enablers and servant-leadership align to support the critical success factors required as listed in Table 1.

A leadership style capable of inspiring followers is suggested for the future brought about by the 4th Industrial Revolution. A servant-leader sets, translates and executes the vision with the focus of enabling individuals to become better individuals that contribute to the organisation and society at large 23]. This is achieved through an approach that is people oriented and democratic [19]. Practicing the principles of servant-leadership creates change in workplaces around the world that replaces traditional hierarchy approaches with strong ethical and caring behaviour [18]. With the technology changes predicted, ethical application for the greater good would become more important.

TABLE 2. Mapping of Agile and servant-leadership enablers to critical success factors of the 4th industrial revolution.

Critical success factor for enablement of 4th Industrial Revolution	Agile enablers	Servant-leadership enablers
Leadership	• Facilitator role compared to traditional controlling role [19]	• Two roles: visionary (top down) and implementation (bottom up) [22, 23] • Higher purpose vision, to benefit employees, organisation and society [23] • Value system that serves others [24]
Change	• Embrace change as an opportunity to respond to marketplace changes [19]	• Creating positive change throughout society [18] • Continuous monitoring and change improvements [23]
Organisational agility	• An adaptive system composed by people with the ability to deal with change [20]	
Empowerment	• Continuous adjusting of thinking and involving diverse perspectives in decision-making [17]	• Entrusting employees with authority and responsibility [24] • Involving followers in planning and decisions [24] • Developing others and exposing talent for the greater good [23]
Collaboration and teamwork	• Improve social interaction and promote collaboration [25] • Self-organising teams with interchangeable roles [19]	Teamwork and community approach
Project management	Less rigid and informal project management approach [19]	

B. AGILE

Agile's origins can be traced back to the late 1990s when the Agile Manifesto was launched. The manifesto is based on four statements: (i) individuals and interactions over processes and tools, (ii) working software over comprehensive documentation, (iii) customer collaboration over contract negotiation and (iv) responding to change over following a plan. The original focus of the Agile Manifesto was software development, but it has since been incorporated into all aspects of the organisation such as HR and marketing [26]. Agile per se is just a philosophy covering the 4 statements and 12 principles. It is not a methodology, but rather a mindset that is required to implement information technology projects that incorporate software development projects. There are various Agile methodologies such as Scrum, Extreme Programming (XP), Dynamic Systems Development Method (DSDM), Feature-Driven Development (FDD) and Lean Software Development [27], [28].

Research indicates that Agile methodologies improve the quality of projects, satisfy customers and are more reliable in supporting changes and complexities in software projects [29]. These benefits of Agile methodologies lead to the success of software projects. FIGURE 1 summarises the benefits of Agile methodologies.

The results indicate that organisations are benefiting from the introduction of Agile into the organisation. It is also evident that the initial benefits are much higher but once Agile is embedded into the organisation, the benefits are not as drastic as with the initial introduction. Marnewick *et al.* [10] highlight that the success rate of IT projects within an Agile

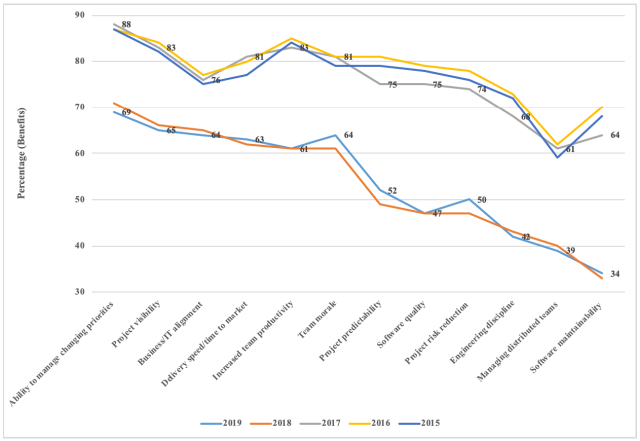

FIGURE 1. Benefits of Agile methodologies [28], [30]–[33].

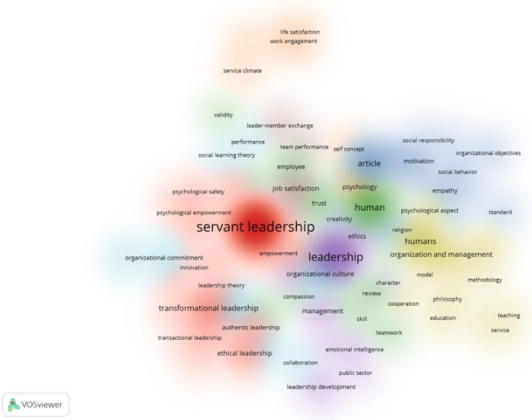

FIGURE 2. Density visualisation.

environment is higher than that of IT projects within a more traditional waterfall environment. The success rate of Agile projects is 77% versus the 54% of waterfall projects.

Two enablers need to be in place before the introduction of Agile as a mindset can be successful [34]:

1) *Conducive culture:* Wurster *et al.* [35] argue that the adoption of Agile is a cultural shift. It requires people, processes and tools to collaborate seamlessly among diverse but simultaneous users. DeMartine *et al.* [36] find that (i) high trust, (ii) the ability to learn quickly from mistakes, (iii) full accountability, (iv) a focus on the customer, (v) continuous improvement and (vi) collaboration form the basis of a conducive culture.
2) *Servant-leadership:* The Agile mindset enforces servant-leadership as a way to empower teams [37], [38]. The servant-leader understands that it is the responsibility of the team to deliver the work and it is the responsibility of the leader (scrum master or Agile project manager) to remove obstacles from the team's path.

Agile is conducive in environments where problems are complex, the potential solutions are at first unclear, project requirements are likely to change, close collaboration with end users is feasible and creative teams will outperform command-and-control groups [27], [29]. This is the kind of environment that is created by the 4th Industrial Revolution and where solutions will be implemented in an Agile way [39].

C. SERVANT-LEADERSHIP

Leadership, according to Amanchukwu *et al.* [40], is the influence over a group of people that is used to realise the organisational goals. There are various leadership styles that have arisen over the last couple of decades, ranging from autocratic, bureaucratic, charismatic, participative, laissez-faire, transactional, transformational, servant-leadership, authentic, ethical and spiritual [40], [41]. Leadership style is influenced by various factors such as the size of the organisation, the level of interaction needed and the personality of the people [40]. It influences the way people perform and is an important predictor of how a team will perform [42].

The preferred leader styles for the new ways of working are transactional, transformational and laissez-faire [42], [43]. Servant-leadership is the preferred type of leadership for the 4th Industrial Revolution. This can be deduced from literature reporting on 4th Industrial Revolution solutions that are best implemented using an Agile mindset, which in turn enforces servant-leadership. A search on Scopus on the terms servant-leadership or servant leadership resulted in 722 articles. A density visualisation map created six clusters as depicted in Figure 2. Various other leadership styles are co-occurring with servant-leadership, e.g. transformational leadership and transactional leadership. This is also a phenomenon identified by [41]. An interesting observation is that organisational culture is co-occurring with terms such as collaboration, organisational commitment and performance, which form part of the culture enabler for Agile [34].

Being a servant-leader implies that the project manager focuses first of all on facilitating the performance and development of each individual project team member [44]. The focus should be on the team members, and project managers should not engage in actions that are manipulative and self-interested. Servant-leader project managers' focus should also be on the interest of the organisation per se [41]. According to Winston and Fields [44], the servant-leader encourages the development of autonomy and responsibility of each individual project team member. Table 3 provides an overview of the attributes of a servant-leader.

It is evident from Table 3 that there is no agreement amongst researchers about the attributes of servant-leadership. At best, there are some overlaps, with authenticity as the most common attribute.

Disruptions brought about by the 4th Industrial Revolution should be seen as an opportunity and not necessarily as a threat [48]. This implies a culture that is ready and embraces constant change and disruptions. Organisations rely on project managers to have the necessary skills and know-how regarding how to manage the impact of the disruptive nature of the 4th Industrial Revolution. Apart from managing

TABLE 3. Servant-leadership attributes as per literature.

Attribute	[45]	[23]	[46]	[47]
Empowerment	X		X	
Accountability	X	X		
Standing back	X			X
Humility	X	X		
Authenticity	X	X		X
Courage	X	X		
Interpersonal acceptance	X			
Stewardship	X			
Compassion		X		
Altruism		X		
Integrity		X	X	
Listening			X	
Vision			X	
Honesty			X	
Trust			X	
Service			X	
Modelling			X	
Pioneering			X	
Appreciation of others			X	
Covenantal relationship				X
Responsible morality				X
Transcendental spirituality				X
Transforming influence				X

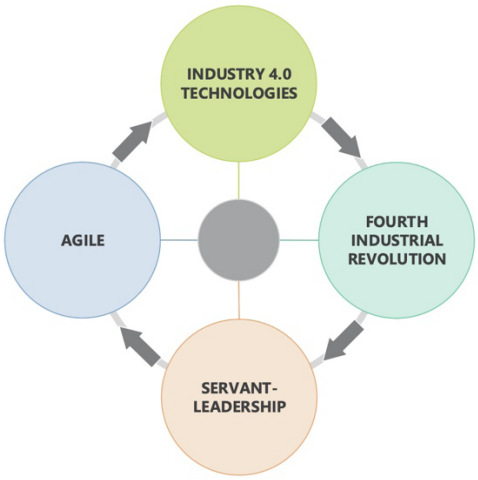

FIGURE 3. Relationship.

these disruptive changes, project managers are required to have the technological expertise to harvest the benefits of the 4th Industrial Revolution's technologies such as artificial intelligence and machine learning. These new technologies require agility and speed from the project team. Project team agility and speed are not achieved through a 'command and control' project manager, but through a project manager that exhibits servant-leadership qualities.

Figure 3 highlights the relationship between the concepts of Industry 4.0, the 4th Industrial Revolution, servant-leadership and Agile. The technologies associated with Industry 4.0 create a new way of working and managing people. The direct result is the 4th Industrial Revolution. Managing teams in this new environment requires a servant-leadership style that is conducive for managing Agile teams. Agile as a mindset is needed to implement Industry

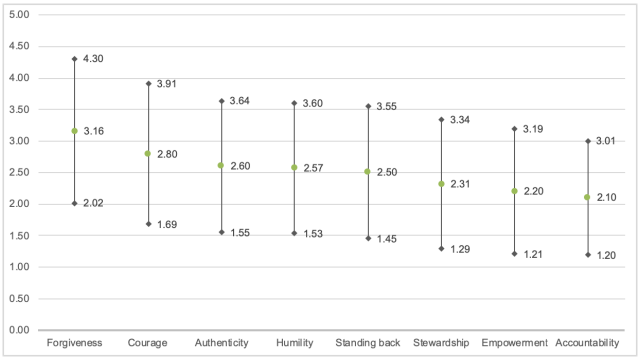

FIGURE 4. Mean and standard deviations of attributes.

4.0 technologies as constant change is brought about by the introduction of these new technologies.

It is evident from Figure 3 that servant-leadership is a key ingredient for the 4th Industrial Revolution.

III. RESEARCH METHODOLOGY

A quantitative approach was adopted to answer the three research questions. A questionnaire was developed focusing on the project manager's level of servant-leadership. This was developed based on the questionnaire designed by van Dierendonck and Nuijten [45]. The reason for this is (i) that there is no agreement on the attributes of servant-leadership as per Table 3 and (ii) van Dierendonck and Nuijten [45]used confirmatory factor analysis to determine the 8 attributes covering 30 elements. These 30 elements formed the basis of the questionnaire where the respondents had to choose the most appropriate response on a 5-point Likert scale. This section was completed from the team's perspective. Using van Dierendonck and Nuijten [45] as the basis of the questionnaire speaks to the construct validity of the questionnaire.

Purposive sampling was used as a sampling technique to gather input from people currently involved in projects. A total of 621 valid responses were received, with the majority of the respondents being project managers (53%), followed by business analysts (11%). The remainder of the respondents (36%) indicated other roles within the project environment. All the respondents were involved in projects in one way or the other. The unit of analysis was project managers within an organisation. The purpose was to determine whether project managers are servant-leaders based on the responses of team members of the project manager.

The questionnaire was tested for reliability by means of Cronbach's alpha. An overall alpha value of 0.763 (30 items) resulted from the analysis and indicated that there was internal consistency.

IV. RESULTS

The results in II show the mean and standard deviations for each of the attributes. The mean of only one attribute (forgiveness) is in the 3 range, with the mean of all the other attributes ranging between 2.80 and 2.10. This implies that the respondents mostly disagreed that the project managers

TABLE 4. Servant-leadership attributes.

Ranking	Servant-leadership attributes	Percentage
1	Forgiveness	63.21
2	Courage	55.85
3	Authenticity	51.84
4	Humility	51.25
5	Standing back	49.94
6	Stewardship	46.27
7	Accountability	44.99
8	Empowerment	43.99

exhibited these attributes. The exception is the forgiveness attribute where the responses were mostly undecided. When the standard deviation is taken into consideration, then the results vary between strongly disagree and undecided, with Forgiveness again as the exception ranging between disagree and agree.

Overall, project managers were found to be servant-leaders 49.88% of the time or in other words, only half of the time they were servant-leaders. The other half of the time they were in a 'command and control' mindset. Frequent delivery of the product or solution is a prerequisite for the 4th Industrial Revolution and this is achieved through Agile project management [34]. In this environment, project managers should exhibit a servant-leadership style and not a 'command and control' management style. Given the fact that project managers were servant-leaders in only 50% of the instances, this creates a challenge in the quick and iterative delivery of projects. It can be inferred that South African project managers are battling to implement projects within a 4th Industrial Revolution environment and will continue to do so.

An average weighted score was calculated for each attribute to determine its ranking and importance. The weighted average score was calculated by multiplying a specific response on the Likert scale by the number of responses. The maximum available score was 93 150 (30 questions × 5 options × 621 respondents). The total score was 46 466, which equates to 49.88%. This score implies that the project managers acted as servant-leaders as well as 'command and control' leaders. This dichotomy might be attributed to the fact that the implementation of Agile, as a way to manage projects, is a fairly new approach within South African organisations. It might also be due to the fact that this is a new type of leadership that both the project manager and project team must get accustomed to.

Table 4 highlights the servant-leadership attributes that project managers exhibited during the course of their projects. Attributes such as empowerment and accountability were not attributes that they portrayed. These attributes are essential in an Agile environment where teams are expected to take ownership of and accountability for their own work. These results do not compare favourably with the list of attributes as highlighted by theory (Table 3).

These results correspond with the results in II, confirming the importance order of the attributes.

It is interesting to note that project managers found it difficult to empower their team members and keep them accountable for their actions and decisions. This behaviour is more in line with a 'command and control' mindset, which is not conducive for an environment dictated by innovation and responsiveness.

TABLE 5. Top 10 servant-leadership behaviours.

Servant-leadership behaviour	Attribute	Total average score
My manager keeps criticizing people for the mistakes they have made in their work	Forgiveness	2004
My manager finds it difficult to forget things that went wrong in the past	Forgiveness	1977
My manager maintains a hard attitude towards people who have offended him/her at work	Forgiveness	1907
My manager takes risks even when he/she is not certain of the support from his/her own manager	Courage	1826
My manager learns from criticism.	Humility	1733
My manager is open about his/her limitations and weaknesses.	Authenticity	1700
My manager takes risks and does what needs to be done in his/her view.	Courage	1642
My manager tries to learn from the criticism he/she gets from his/her superior.	Humility	1636
My manager appears to enjoy his/her colleagues' success more than his/her own.	Standing back	1610
My manager is often touched by the things he/she sees happening around him/her	Authenticity	1603

Of the top ten behaviours as listed in IV-A, three are from the *Forgiveness* attribute and two each from the *Courage*, *Authenticity* and *Humility* categories. Only one behaviour emanated from the *Standing back* attribute. Three of the attributes are not present, i.e. *Empowerment*, *Accountability* and *Stewardship*.

All the behaviours that are part of *Forgiveness* and *Courage* are included in the top ten, with *Authenticity* at 50%, *Humility* at 40% and *Standing back* at 33%.

Three attributes fall within the bottom ten behaviours, i.e. *Empowerment* (6), *Accountability* (2) and *Stewardship* (2). *Empowerment* is present 86% of the time, *Accountability* 67% and *Stewardship* 33% of the time.

Exploratory factor analysis was run to determine which attributes were dominant or even absent.

A. EXPLORATORY FACTOR ANALYSIS (EFA)

The purpose of EFA was to condense the 30 variables into fewer latent variables. This made the interpretation and presentation of the results easier. For the purpose of this article, maximum likelihood as an extraction method, Promax with Kaiser normalisation as an oblique rotation and the interpretation of scree plots and factor plots in rotated factor space were used to achieve the optimum results.

The first test of adequacy is the KMO test. In this case, the KMO is 0.913, which is perceived as excellent [45]. The second test of adequacy focuses on the communalities. To achieve an extraction of greater than 0.3 for all factors, 6 factors (C24, C23, C7, C15, C28 and C17) were removed.

TABLE 6. Bottom 10 servant-leadership behaviours.

Servant-leadership behaviour	Attribute	Total average score
My manager holds me and my colleagues responsible for the way we handle a job.	Accountability	1449
My manager emphasizes the importance of focusing on the good of the whole.	Stewardship	1446
My manager helps me to further develop myself.	Empowerment	1410
My manager has a long-term vision	Stewardship	1388
My manager encourages his/her staff to come up with new ideas.	Empowerment	1386
My manager offers me abundant opportunities to learn new skills.	Empowerment	1384
My manager gives me the authority to take decisions which make work easier for me.	Empowerment	1361
My manager encourages me to use my talent.	Empowerment	1290
My manager gives me the information I need to do my work well.	Empowerment	1278
I am held accountable for my performance by my manager.	Accountability	1250

TABLE 7. Communalities: Extraction > 0.3.

	Initial	Extraction
C1	0.391	0.418
C2	0.483	0.487
C3	0.511	0.638
C4	0.468	0.493
C5	0.356	0.365
C6	0.328	0.379
C8	0.216	0.335
C9	0.37	0.359
C10	0.516	0.577
C11	0.395	0.4
C12	0.36	0.328
C13	0.321	0.324
C14	0.327	0.475
C16	0.24	0.458
C18	0.507	0.559
C19	0.482	0.524
C20	0.485	0.485
C21	0.387	0.383
C22	0.433	0.581
C25	0.43	0.484
C26	0.458	0.515
C27	0.473	0.51
C29	0.503	0.525
C30	0.412	0.435

Extraction method: Maximum likelihood

The remaining 24 factors all have an extraction value greater than 0.3, as indicated in Table 7.

The third test for adequacy focused on assessing the total variance explained. Table 8 presents the explained total variance results. The EFA identified 5 factors. The cumulative percentage was 57.05%, implying that the 5 factors account for 57.05% of the total variance within the dataset. This result is deemed acceptable.

Goodness-of-fit was assessed as the fourth test for adequacy. These results are given in Table 9. The significance

TABLE 8. Total variance explained.

Factor	Total	% of variance	Cumulative %
1	7.567	31.528	31.528
2	2.215	9.23	40.758
3	1.471	6.129	46.887
4	1.352	5.631	52.519
5	1.087	4.531	57.05

TABLE 9. Goodness-of-fit.

Chi square	df	Sig.
440.993	166	0.000

TABLE 10. Cronbach's alpha results.

Factor	Cronbach's alpha	Interpretation
Factor 1	0.837	Good
Factor 2	0.815	Good
Factor 3	0.782	Acceptable
Factor 4	0.623	Questionable
Factor 5	0.413	Unacceptable

value is less than 0.05, implying that the EFA results are valid and adequate.

In order to ensure EFA reliability, Cronbach's alpha reliability test was applied. The Cronbach's alpha threshold was set at greater than 0.7. Table 10 illustrates the reliability results. The Cronbach's alpha results indicate that three of the five factor groupings were above the 0.7 threshold. Factor grouping 4 was 0.623 and factor grouping 5 was 0.413.

The EFA resulted in five factors that can be labelled as *Humility*, *Miscellaneous*, *Empowerment*, *Accountability* and *Courage*. The *Miscellaneous* factor consists of behaviours from the original *Empowerment* (2), *Standing back* (1), *Stewardship* (2), *Humility* (1) and *Authenticity* (1) attributes.

These five final attributes differ from the results from II and Table 4, with four attributes discarded, i.e. *Standing back*, *Forgiveness*, *Authenticity* and *Stewardship*. Seven behaviours from the original attributes are incorporated into the *Miscellaneous* attribute.

A comparison with the results of van Dierendonck and Nuijten [45] highlights some differences and similarities. Each of the five new attributes are compared with original attributes as per van Dierendonck and Nuijten [45].

1) *Courage:* This attribute consists of the same behaviours as the original attribute.
2) *Accountability:* This attribute consists of the same behaviours as the original attribute.
3) *Empowerment:* The new attribute consists of only four behaviours, whereas the original attribute consisted of seven. These four behaviours (C1, C2, C3 and C4) were part of the original behaviours. Behaviours C12 and C27 are now part of the new *Miscellaneous* attribute and C20 is part of the *Humility* attribute.

TABLE 11. Summary of maximum likelihood EFA (final iteration).

		FACTOR				
	Observed variable	1	2	3	4	5
Humility	C10	0.800				
	C18	0.735				
	C29	0.652				
	C20	0.533				
	C13	0.515				
	C21	0.467				
	C30	0.465				
	C11					
Miscellaneous	C25		0.722			
	C26		0.699			
	C19		0.554			
	C5		0.544			
	C27		0.467			
	C9		0.436			
	C12		0.412			
Empowerment	C3			0.783		
	C4			0.624		
	C2			0.599		
	C1			0.416		
Accountability	C14				0.699	
	C22				0.546	
	C6				0.489	
Courage	C16					0.664
	C8					0.501
	Extraction method: Maximum likelihood Rotation method: Promax with Kaiser normalisation Rotation converged in 8 iterations					

4) *Humility:* This attribute consists now of seven behaviours versus the original five. The three new behaviours are C20 (*Empowerment*) and C13 and C21 from the *Standing back* attribute. Logically it makes sense that the two *Standing back* behaviours form part of the *Humility* attribute. C20 focuses on enabling people to solve problems themselves without any interference. This seems like an anomaly, but it can be interpreted that the project manager exhibits humility in enabling people to solve problems themselves. C25 was dropped from this attribute and was incorporated into the *Miscellaneous* attribute. C25 speaks to the fact that project managers admit to their mistakes.
5) *Miscellaneous:* This is a totally new attribute consisting of seven behaviours from the *Empowerment* (2), *Standing back* (1), *Stewardship* (2), *Humility* (1) and *Authenticity* (1) attributes. An analysis of the respective behaviours does not necessarily make logical sense as it includes behaviours such as the project manager admits his/her mistakes, the project manager keeps himself/herself in the background and the project manager delegates authority.

TABLE 12. Servant-leadership attributes comparison.

Ranking	Servant-leadership attributes	Percentage (old)	Percentage (new)
1	Courage	55.85	55.85
2	Humility	51.25	50.89
3	Miscellaneous	-	47.44
4	Accountability	44.99	44.99
5	Empowerment	43.99	43.19

The EFA resulted in the removal of seven behaviours, i.e. C7, C11, C15, C17, C23, C24 and C28. If the weighted average score is calculated again, then the average drops from 49.88% to 39.62%, which is a 10% drop. This implies that although project managers exhibit some servant-leadership behaviours, they still rely on a 'command and control' leadership style. Table 12 compares the old averages with the new averages based on the new attributes and their subsequent behaviours.

There is not a huge discrepancy between the old and new attributes, apart from the introduction of the *Miscellaneous* attribute. Another difference is that the ranking has changed due the omission of three attributes from the original list of attributes. According to van Dierendonck and Nuijten [45], *Courage* is the attribute that distinguishes the servant-leader from other leaders, as the servant-leader challenges conventional models of working. *Courage* is also essential for innovation and creativity as dictated by Agile.

Table 13 shows the correlations between the five attributes. Four of the attributes have moderately strong correlations with each other that are significant at a 0.01 level. The exception is *Courage* which has a weak or very weak correlation with the other four attributes, although they are significant at a 0.01 level.

It can be concluded from the correlations that these attributes influence each other to a certain extent. To become more of a servant-leader, project managers need to address all the attributes and the underlying behaviours as these attributes are interrelated.

V. DISCUSSION

This article focuses on the servant-leadership attributes of South African project managers. The reason for this focus is that servant-leadership is perceived as the precursor to successful Agile implementations [49]. Agile, in turn, is

TABLE 13. Correlation between attributes.

		Humility	Miscellaneous	Empowerment	Accountability	Courage
Humility	Pearson Correlation		.546**	.532**	.424**	.214**
	Sig. (2-tailed)		0	0	0	0
	N		621	621	621	621
Miscellaneous	Pearson Correlation	.546**		.593**	.359**	.157**
	Sig. (2-tailed)	0		0	0	0
	N	621		621	621	621
Empowerment	Pearson Correlation	.532**	.593**		.444**	.132**
	Sig. (2-tailed)	0	0		0	0.001
	N	621	621		621	621
Accountability	Pearson Correlation	.424**	.359**	.444**		.151**
	Sig. (2-tailed)	0	0	0		0
	N	621	621	621		621
Courage	Pearson Correlation	.214**	.157**	.132**	.151**	
	Sig. (2-tailed)	0	0	0.001	0	
	N	621	621	621	621	

** Correlation is significant at the 0.01 level (2-tailed).

crucial for the implementation of Industry 4.0 technologies as illustrated in.

The eight servant-leadership attributes as identified by van Dierendonck and Nuijten [45] were used to benchmark the South African project managers.

The results highlight that South African project managers do not necessarily portray the behaviours associated with servant-leadership. An average of 49.88% was calculated based on an average weighted score, implying that the project managers surveyed portrayed the behaviours half of the time. The assumption is made that the project managers revert back to a different type of leadership the other half of the time. The attribute that emerged as the strongest is *Forgiveness,* with *Empowerment* as the lowest scoring attribute. One of the Agile Manifesto's statements focuses on individuals and interactions, implying that the team members should be empowered to make decisions [50]. This indicates a more hands-off or distant approach from the project manager, which is almost counter-intuitive as project management requires more of a command and control style. Embracing the attributes of a servant-leadership style means a different mindset as highlighted by [34].

The EFA reduced the 8 attributes of [45] to 5 and reduced the 30 behaviours down to 23. One attribute is actually a new attribute consisting of 7 behaviours from 5 other attributes. The 4 consistent attributes are *Courage*, *Humility*, *Accountability* and *Empowerment*. The results of the EFA contradict the results as displayed in II and Table 4. The highest ranked attribute (*Forgiveness*) as well as the third-ranked attribute (*Authenticity*) were totally excluded from the final 5 attributes. Figure 2 indicates that transformational and transactional leadership styles are related to servant-leadership. This sentiment is echoed by Stone *et al.* [51] stating that the difference between a servant-leader and a transformational leader is the focus of the leader. A transformational leader focuses on the engagement with organisational strategies and objectives. The servant-leader focuses primarily on service to the team members. The exclusion of three attributes might imply that project managers are still evolving from transformational leaders to servant-leaders. The five new attributes all form part of the servant-leadership attributes as highlighted in Table 3. What is evident from the results is that attributes and behaviours of servant-leadership are still not fixed and that there is still a debate on what constitutes servant-leadership.

The transition into servant-leaders is supported by the results in Table 12. These results indicate that the project managers exhibit most of the behaviours some of the time. The ideal would be that they exhibit these behaviours all the time, but it can be expected that this is not the case when they are transitioning to a servant-leadership style. The question is whether this is enough to implement Industry 4.0 technologies through an Agile approach and mindset.

In relation to the research questions posed earlier, the following can be deduced:

1. South African project managers are to an extent servant-leaders. They perform the behaviours some of the time, meaning that they are servant-leaders 48.87% of the time. The remainder of the time it is assumed that they revert back to a more formal 'command and control' approach as dictated by the formal project management methodologies. Changing the leadership style is not something that will happen overnight. Certain enablers must be in place, such a conducive environment that allows for a servant-leadership style [34].
2. The EFA clearly highlights that there are four distinct attributes and one attribute that encompasses various diverse behaviours. The four dominant attributes are *Courage*, *Humility*, *Accountability* and *Empowerment*. The fifth attribute is labelled *Miscellaneous*.
3. Comparing the South African project managers to other studies is difficult. There are no other studies determining the leadership style of Agile project managers; hence the dependence on more leadership articles. The results compare favourably with the results displayed in Table 3. Four of the five attributes are part of the global list, apart from the *Miscellaneous* attribute.

VI. CONCLUSION

The advent of the 4th Industrial Revolution requires novel ways of managing project teams. This is a direct consequence

of the speed that is required to implement Industry 4.0 technologies as a precursor to the 4th Industrial Revolution. It is debated that Agile is a better way to implement 4th Industrial Revolution related projects. This way of implementing projects requires the project manager to have a servant-leader style. The article provided an overview of the 4th Industrial Revolution and Agile with an in-depth analysis of the attributes of servant-leadership.

Given the detailed analysis of the servant-leader construct, various conclusions can be made. The first is that South African project managers are in the process of evolving from more traditional leadership styles into servant-leaders. This can be attributed to the following: (i) the 4th Industrial Revolution and its associated technologies are still a new phenomenon in South Africa and it is only now that organisations are starting to focus on the implementation of technologies such as artificial intelligence and machine learning; (ii) using Agile to implement projects requires a different way of managing team members which is different from the training that project managers have received. This implies that they need to change their mindset; this is a process and not something that happens overnight. The second conclusion, based on the results, is that to be a servant-leader is associated with some complexity. Five attributes have been identified with 23 behaviours, making it more complex than a more autocratic leadership style. This complexity is further enhanced as the 5 attributes are positively correlated with each other. Project managers need to be aware of the 23 behaviours and actively exhibit these behaviours to grow as servant-leaders.

This article provides valuable insight into the leadership style of project managers. Firstly, organisations and project managers should be aware that the 4th Industrial Revolution requires new ways of managing projects. This new way is servant-leadership and the research indicates this gap where South African project managers are still a long way off from being servant-leaders. Organisations should create a more conducive environment that allows for an Agile mindset and the exhibiting of servant-leadership. South African organisations are going to battle to compete with other local as well as international organisations if they do not speed up the delivery of their projects. Secondly, this is the first time that the leadership style of project managers has been measured based on servant-leadership. This contributes to the current body of knowledge and opens the door for academic debate and further research. The articles cited in this article focus on the phenomenon of servant-leadership and not on the application of this phenomenon in the workplace. This article determines the impact of servant-leadership on project managers and thus deviates from the more traditional research on leadership.

REFERENCES

[1] A. B. L. de Sousa Jabbour, C. J. C. Jabbour, C. Foropon, and M. G. Filho, "When titans meet—Can industry 4.0 revolutionise the environmentally-sustainable manufacturing wave? The role of critical success factors," *Technol. Forecasting Social Change*, vol. 132, pp. 18–25, Jul. 2018, doi: 10.1016/j.techfore.2018.01.017.

[2] O. Kohnke, "It's not just about technology: The people side of digitization," in *Shaping the Digital Enterprise: Trends and Use Cases in Digital Innovation and Transformation*, G. Oswald and M. Kleinemeier, Eds. Cham, Switzerland: Springer, 2017, pp. 69–91.

[3] L. Li, "China's manufacturing locus in 2025: With a comparison of 'Made-in-China 2025' and 'Industry 4.0,'" *Technol. Forecasting Social Change*, vol. 135, pp. 66–74, Oct. 2018, doi: 10.1016/j.techfore.2017.05.028.

[4] D. P. Perales, F. A. Valero, and A. B. García, Eds. "Industry 4.0: A classification scheme," in *Closing the Gap Between Practice and Research in Industrial Engineering* (Lecture Notes in Management and Industrial Engineering). Cham, Switzerland: Springer, 2018, pp. 343–350.

[5] P. K. Muhuri, A. K. Shukla, and A. Abraham, "Industry 4.0: A bibliometric analysis and detailed overview," *Eng. Appl. Artif. Intell.*, vol. 78, pp. 218–235, Feb. 2019, doi: 10.1016/j.engappai.2018.11.007.

[6] K. Schwab, *The Fourth Industrial Revolution*. London, U.K.: Penguin, 2017.

[7] A. C. Pereira and F. Romero, "A review of the meanings and the implications of the Industry 4.0 concept," *Procedia Manuf.*, vol. 13, pp. 1206–1214, Jan. 2017, doi: 10.1016/j.promfg.2017.09.032.

[8] M. Sony and S. Naik, "Key ingredients for evaluating Industry 4.0 readiness for organizations: A literature review," *Benchmarking, Int. J.*, 2019, doi: 10.1108/BIJ-09-2018-0284.

[9] H. Lasi, P. Fettke, H.-G. Kemper, T. Feld, and M. Hoffmann, "Industry 4.0," *Bus. Inf. Syst. Eng.*, vol. 6, no. 4, pp. 239–242, Aug. 01 2014, doi: 10.1007/s12599-014-0334-4.

[10] C. Marnewick, W. Erasmus, and N. Joseph, *The Symbiosis Between Information System Project Complexity and Information System Project Success*. Cape Town, South Africa: AOSIS, 2017, p. 184.

[11] Y. Liao, F. Deschamps, E. D. F. R. Loures, and L. F. P. Ramos, "Past, present and future of Industry 4.0—A systematic literature review and research agenda proposal," *Int. J. Prod. Res.*, vol. 55, no. 12, pp. 3609–3629, 2017.

[12] M. Sony and S. S. Naik, "Ten lessons for managers while implementing Industry 4.0," *IEEE Eng. Manag. Rev.*, vol. 47, no. 2, pp. 45–52, Jun. 2019, doi: 10.1109/EMR.2019.2913930.

[13] C. Marnewick and A. Marnewick, "The 4th industrial revolution: A readiness assessment of South African project managers," presented at the EURAM, Exploring Future Manage., Lisbon, Portugal, Jun. 2019.

[14] J. K.-U. Brock and F. von Wangenheim, "Demystifying AI: What digital transformation leaders can teach you about realistic artificial intelligence," *California Manage. Rev.*, vol. 61, no. 4, pp. 110–134, Aug. 2019, doi: 10.1177/1536504219865226.

[15] H. Schroth, "Are you ready for gen Z in the workplace?" *California Manage. Rev.*, vol. 61, no. 3, pp. 5–18, May 2019, doi: 10.1177/0008125619841006.

[16] S. Berman and A. Marshall, "The next digital transformation: From an individual-centered to an everyone-to-everyone economy," *Strategy Leadership*, vol. 42, no. 5, pp. 9–17, 2014, doi: 10.1108/SL-07-2014-0048.

[17] R. J. Thomas, J. Bellin, C. Jules, and N. Lynton, "Global leadership teams: Diagnosing three essential qualities," *Strategy Leadership*, vol. 40, no. 3, pp. 25–29, 2012, doi: 10.1108/10878571211221185.

[18] S. Finley, "Servant-leadersip: A literature review," *Rev. Manage. Innov.*, vol. 5, no. 14, pp. 135–144, 2012. [Online]. Available: http://0-search.ebscohost.com.ujlink.uj.ac.za/login.aspx?direct=true&db=bsu&AN=94256172&site=ehost-live&scope=site

[19] N. A. Bonner, "Predicting leadership success in Agile environments: An inquiring systems approach," *Acad. Inf. Manage. Sci. J.*, vol. 13, no. 2, pp. 83–103, 2010. [Online]. Available: http://0-search.ebscohost.com.ujlink.uj.ac.za/login.aspx?direct=true&db=bsu&AN=55418845&site=ehost-live&scope=site

[20] D. W. Parker, "Improving productivity with self-organised teams and agile leadership," *Int. J. Productiv. Perform. Manage.*, vol. 64, no. 1, pp. 112–128, 2015, doi: 10.1108/IJPPM-10-2013-0178.

[21] E. Godfrey and L. Parker, "Mapping the cultural landscape in engineering education," *J. Eng. Edu.*, vol. 99, no. 1, pp. 5–22, 2010, doi: 10.1002/j.2168-9830.2010.tb01038.x.

[22] K. Blanchard, "Servant-leadership revisited," in *Insights on Leadership*. L. Spears, Ed. New York, NY, USA: Wiley, 1996.

[23] M. Coetzer, M. Bussin, and M. Geldenhuys, "The functions of a servant leader," *Administ. Sci.*, vol. 7, no. 1, p. 5, 2017. [Online]. Available: http://www.mdpi.com/2076-3387/7/1/5

[24] R. F. Russell, "The role of values in servant leadership," *Leadership Org. Develop. J.*, vol. 22, no. 2, pp. 76–84, 2001, doi: 10.1108/01437730110382631.

[25] H. Shaughnessy, "Creating digital transformation: Strategies and steps," *Strategy Leadership*, vol. 46, no. 2, pp. 19–25, 2018, doi: 10.1108/SL-12-2017-0126.
[26] D. K. Rigby, J. Sutherland, and A. Noble, "Agile at Scale," *Harvard Bus. Rev.*, vol. 96, no. 3, pp. 88–96, 2018. [Online]. Available: http://0-search.ebscohost.com.ujlink.uj.ac.za/login.aspx?direct=true&db=bth&AN=129192576&site=ehost-live&scope=site
[27] T. S. da Silva, B. Estácio, J. Kroll, and R. M. Fontana, Eds., *Agile Methods*. New York, NY, USA: Springer, 2016.
[28] VersionOne Inc. (2019). *The 13th Annual State of Agile Report, VersionOne*. Accessed: May 9, 2019. [Online]. Available: https://www.stateofagile.com/#ufh-i-521251909-13th-annual-state-of-agile-report/473508
[29] I. Ghani and M. Bello, "Agile adoption in IT organizations," *KSII Trans. Internet Inf. Syst.*, vol. 9, no. 8, pp. 3231–3248, 2015, doi: 10.3837/tiis.2015.08.029.
[30] VersionOne Inc., Atlanta, GA, USA. (2015). *9th Annual State of Agile Survey*. Accessed: Mar. 25, 2019. [Online]. Available: https://explore.versionone.com/state-of-agile/9th-annual-state-of-agile-report-2
[31] VersionOne Inc. (2016). *The 10th Annual State of Agile Report, VersionOne*. Accessed: Mar. 25, 2019. [Online]. Available: https://versionone.com/pdf/VersionOne-10th-Annual-State-of-Agile-Report.pdf
[32] VersionOne Inc. (2017). *The 11th Annual State of Agile Report, VersionOne*. Accessed: Mar. 25, 2019. [Online]. Available: https://explore.versionone.com/state-of-agile/versionone-11th-annual-state-of-agile-report-2
[33] VersionOne Inc. (2018). *The 12th Annual State of Agile Report, VersionOne*. Accessed: Apr. 12, 2018. [Online]. Available: https://explore.versionone.com/state-of-agile/versionone-12th-annual-state-of-agile-report
[34] C. Marnewick and J. Langerman, "Agile maturity: The first step to information technology project success," in *Developing Organizational Maturity for Effective Project Management* (Advances in Logistics, Operations, and Management Science), G. Silvius and G. Karayaz, Eds. Hershey, PA, USA: IGI Global, 2018, pp. 233–252.
[35] L. F. Wurster, R. J. Colville, C. Haight, S. Tripathi, and A. Rastogi, "Emerging technology analysis: DevOps a culture shift, not a technology," Gartner Inc., Stamford, CT, USA, Tech. Rep. G00249135, Aug. 2013.
[36] A. DeMartine, E. Oehrlich, and M. Doerr. CALMSS: A Model for Assessing Modern Service Delivery. Forrester Research, Aug. 13, 2015. [Online]. Available: https://www.forrester.com/report/CALMSS+A+Model+For+Assessing+Modern+Service+Delivery/-/E-RES122633
[37] Project Management Institute, *Agile Practice Guide*. Newtown, PA, USA: Project Management Institute, 2017, p. 183.
[38] D. Canty, *Agile for Project Managers* (Best Practices and Advances in Program Management). Boca Raton, FL, USA: CRC Press, 2015, p. 240.
[39] C. Marnewick and A. Marnewick, "Insights into managing project teams for Industry 4.0," in *Agile Approaches for Successfully Managing and Executing Projects in the Fourth Industrial Revolution*, H. B. Bolat and G. T. Temur, Eds. Hershey, PA, USA: IGI Global, 2019, ch. 6, pp. 99–118.
[40] R. N. Amanchukwu, G. J. Stanley, and N. P. Ololube, "A review of leadership theories, principles and styles and their relevance to educational management," *Management*, vol. 5, no. 1, pp. 6–14, 2015, doi: 10.5923/j.mm.20150501.02.
[41] M. H. Anderson and P. Y. T. Sun, "Reviewing leadership styles: Overlaps and the need for a new 'full-range' theory," *Int. J. Manage. Rev.*, vol. 19, no. 1, pp. 76–96, Jan. 2017, doi: 10.1111/ijmr.12082.
[42] R. Yahaya and F. Ebrahim, "Leadership styles and organizational commitment: Literature review," *J. Manage. Develop.*, vol. 35, no. 2, pp. 190–216, 2016, doi: 10.1108/JMD-01-2015-0004.
[43] B. M. Bass, *Leadership and Performance Beyond Expectations*. New York, NY, USA: Free Press, 1985.
[44] B. Winston and D. Fields, "Seeking and measuring the essential behaviors of servant leadership," *Leadership Org. Develop. J.*, vol. 36, no. 4, pp. 413–434, 2015, doi: 10.1108/LODJ-10-2013-0135.
[45] D. van Dierendonck and I. Nuijten, "The servant leadership survey: Development and validation of a multidimensional measure," *J. Bus. Psychol.*, vol. 26, no. 3, pp. 249–267, Sep. 2011, doi: 10.1007/s10869-010-9194-1.
[46] R. F. Russell and S. A. Gregory, "A review of servant leadership attributes: Developing a practical model," *Leadership Org. Develop. J.*, vol. 23, no. 3, pp. 145–157, 2002, doi: 10.1108/01437730210424.
[47] S. Sendjaya and A. Pekerti, "Servant leadership as antecedent of trust in organizations," *Leadership Org. Develop. J.*, vol. 31, no. 7, pp. 643–663, 2010, doi: 10.1108/01437731011079673.
[48] Project Management Institute, Inc. Newtown, PA, USA. (Sep. 2018). *The Project Manager of the Future: Developing Digital-Age Project Management Skills to Thrive in Disruptive Times*. [Online]. Available: https://www.pmi.org/learning/thought-leadership/pulse/the-project-manager-of-the-future?utm_source=pmi&utm_medium=website&utm_term=DXP6950&utm_content=HomePage_HeroImage&utm_campaign=Pulse2018&utm_aud=PMIwebsite&utm_thm=learning_thought_leadership_Pulse&utm_sdte=09_17_18&utm_dep=mkt
[49] P. Lous, P. Tell, C. B. Michelsen, Y. Dittrich, and A. Ebdrup, "From scrum to agile: A journey to tackle the challenges of distributed development in an agile team," presented at the Int. Conf. Softw. Syst. Process., Gothenburg, Sweden, 2018.
[50] B. Hobbs and Y. Petit, *Agile Approaches on Large Projects in Large Organizations*. Newtown Square, PA, USA: Project Management Institute, 2017, p. 133.
[51] G. A. Stone, R. F. Russell, and K. Patterson, "Transformational versus servant leadership: A difference in leader focus," *Leadership Org. Develop. J.*, vol. 25, no. 4, pp. 349–361, 2004, doi: 10.1108/01437730410538671.

ANNLIZÉ L. MARNEWICK received the B.Ing. degree in electrical and electronic engineering from Potchefstroom University, the B.Sc. degree (Hons.) in applied mathematics from Rand Afrikaans University, and the M.Ing. and D.Ing. degrees in engineering management from the University of Johannesburg. She worked in industry for 14 years as a requirements engineer. She is currently an Associate Professor with the Postgraduate School of Engineering Management, University of Johannesburg. Her research focus is solving cross-discipline industry problems through the application of systems engineering principles. She is a registered Professional Engineer.

CARL MARNEWICK received the B.Sc., B.Sc. (Hons.), M.Sc., and Ph.D. degrees in computer science from the Potchefstroom University for Christian Higher Education, Potchefstroom, South Africa, in 1989, 1990, 1992, and 2009, respectively. He is currently a Professor with the University of Johannesburg, South Africa. The focus of his research is the overarching topic and special interest of the strategic alignment of IT projects to the vision of the organization. A natural outflow of the research is the realization of benefits to the organization through the implementation of IT/IS systems. Benefits realization is part of a complex system and his research to date has identified impediments in the realization of benefits. He is currently the Head of the Information Technology Project Management Knowledge and Wisdom Research Cluster. This research cluster focuses on research in IT project management and includes, among others, governance, auditing and assurance, complexity, IT project success, benefits management, sustainability, and Agile project management.