LEADERSHIP 4.0: LEADERSHIP CHANGES REQUIRED IN THE SOUTH AFRICAN PETROLEUM INDUSTRY TO SUPPORT THE FOURTH INDUSTRIAL REVOLUTION

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ABSTRACT

The Fourth Industrial Revolution (4IR) is upon us, emerging at a rapid pace and providing digitalisation and technology systems that can improve the agility and efficiency of the South African petroleum industry. Owing to the dynamism of and unfamiliarity with 4IR ways of working, leaders are grappling with how changes brought upon by 4IR affect their role in the organisation. In this study, the current leadership styles employed in the South African petroleum industry were investigated, and the type of leadership style required to lead a 4IR organisation effectively was determined, in order to provide recommendations of changes that leadership needs to undergo to best support the 4IR. A conceptual model was developed in which the study was sub-divided into a pre-4IR phase, transitioning to the 4IR phase, and then to fully functioning 4IR organisations. A structured questionnaire was sent to leaders in the South African petroleum industry, in which they were asked their views on leadership theories, factors influencing leadership, and leadership models pertinent to each of the three phases of 4IR. The findings of the study show that, for leaders to thrive in 4IR, they must move away from authoritarian, bureaucratic, and task-orientated leadership styles and embrace transformational, people-orientated, and charismatic leadership styles.

OPSOMMING

Die Vierde Nywerheidsrewolusie (4NR) is met ons en ontluik teen 'n spoedige pas. Dit maak digitalisering en tegnologie-stelsels beskikbaar wat die ratsheid en doeltreffendheid van die Suid-Afrikaanse petroleumnywerheid verseker. As gevolg van die dinamika en onbekendheid van die 4NR werkswyse, is leiers aan die stoei met hoe die verandering wat deur die 4NR meegebring is hulle rol in die organisasie beïnvloed. Die huidige leierskapstyle wat aangewend word in die Suid-Afrikaanse petroleumnywerheid is in die studie ondersoek om voorstelle te maak vir leierskapsverandering wat die 4NR die beste sal ondersteun. 'n Konsepmodel is ontwikkel waarin die studie onderverdeel is in die voor-4NR fase, oorgangsfase na die 4NR, en dan in organisasies wat ten volle in die 4NR optree. 'n Gestruktureerde vraelys is na na leiers gestuur binne die Suid-Afrikaanse petroleumnywerheid, waarin hulle siening oor leierskapsteorie, faktore wat leierskap beïnvloed, en leierskapsmodelle wat eie aan die drie fases is, verkry is. Die bevindings van die studie toon dat leiers wat uitnemend wil wees in die 4NR moet wegbeweeg van outoritêre, burokratiese, en taakgefokusde leierskapstyle na oorgangsstyle wat mensgerig en charismaties is.

1   INTRODUCTION: THE NEED FOR LEADERSHIP 4.0

The Fourth Industrial Revolution (4IR) is a term introduced by Professor Klaus Schwab at the World Economic Forum's annual meeting in 2016, in order to describe the current blurring of boundaries between the physical, digital, and biological spheres occurring in today's world [1]. In his book, *The Fourth Industrial Revolution* [2], Schwab describes this period as being a technology and digitalisation revolution in which technologies such as artificial intelligence (AI), the internet of things (IoT), and robotics are merging with our lives and ultimately leading to a societal transformation — as happened as a result of previous industrial revolutions.

The South African petroleum industry, comprising the production of petroleum and petroleum derivative products including diesel, jet fuel, paraffin, and liquefied petroleum gas, and petrochemicals such as solvents, plastics, and waxes, is expected to benefit immensely from 4IR through engineering design, process control, safety, logistics, and product and service innovation. This industry contributes 8.5% of the country's gross domestic product (GDP) [3]; and while the European Union is pursuing initiatives to increase the use of renewable energy [4], the improvement in the quality of life seen in developing countries creates an increased worldwide demand for energy. Thus it is foreseen that the petroleum industry will continue to be a prominent contributor to the global energy environment for the foreseeable future. 4IR provides the ability to improve the manner in which the petroleum industry operates by providing technological tools to enable the industry to perform in a more efficient and agile manner, allowing it to respond better to the fluctuations in crude oil prices, to adhere to environmental legislation, and to reduce its operating costs. A highly digitalised petroleum industry would also assist with future planning in an industry that historically has had a large carbon footprint and needs to be clear about its contribution to environmental sustainability. Using digital twins will not only contribute to process optimisation, but also assist in achieving carbon footprint targets by using virtual modelling. This foreseen impact of 4IR on the petroleum sector is expected to be so profound that the Arab oil-producing countries have labelled it 'Oil and Gas 4.0' [5].

However, while 4IR provides technologies that can greatly enhance the quality of life for everyone, left in the wrong hands it has *"the power to increase disparity, poverty, discrimination and environmental damage [that will] work against the future we seek"* [2]. Furthermore, by introducing cutting-edge technologies and relying more on automated control, 4IR has introduced the need for organisations to be equipped with new skill sets that are better suited for these dynamic times. It is therefore necessary that the leaders who are chosen to spearhead this revolutionary time have the correct attributes for the job, as the role of leaders is of paramount importance in ensuring the successful implementation of the technologies that 4IR brings to organisations.

1.1 Objectives and research questions

The objectives of this study were to investigate the leadership styles currently adopted in the South African petroleum industry with regard to managing the changes brought upon by 4IR; to determine the leadership styles required to manage a 4IR organisation in this industry effectively and efficiently; and thus to make recommendations about the changes that leadership needs to undergo in order for the South African petroleum industry to support 4IR in the best way. This was done by answering the following research questions:

- What are the current leadership approaches that the South African petroleum industry applies in leading the transition towards a 4IR organisation?

- What factors of influence does leadership in the South African petroleum industry face in respect of leading a 4IR organisation?

- What leadership styles, characteristics, and traits are required to guide a 4IR organisation effectively?

- How can leaders in the South African petroleum industry successfully incorporate leadership changes into their organisations in order best to support the transition to 4IR?

2 LITERATURE REVIEW

2.1 Definition of leadership

Grace [6] traces the root word of leadership, 'lead', to its origins around 800 CE and follows its evolution to 'leader' around 1300 AD, finally culminating in the term 'leadership' in the mid-19th century. While Tyssen, Wald and Spieth [7] highlight the various existing definitions of leadership, Rost [8] has discovered that there are over 221 different definitions and concepts of leadership, and Bass [9] argues that the search for a single definition of leadership is pointless. Therefore, for the purpose of this study, the definition as given by House and Mansor [10] is adopted: leadership is *"the ability of an individual to influence, motivate, and enable others to contribute toward the effectiveness and success of the organisation"*.

2.2 Leadership theories, styles and models

2.2.1 Leadership theories

Leadership theory is used to explain the aspects of leadership, identifying the behaviours, characteristics, skills, and traits associated with good leaders, as well as the context in which they lead and their relationship with their followers [11]. Leadership theories provide schools of thought that have been proposed to explain how and why certain individuals become leaders.

Leadership theories have evolved with the passage of time [12]; however, while these theories have been refined and modified over time, none of the theories so developed has been found to be completely irrelevant, with each new research initiative building on the old [13]. Kibbe [12] states that, in order to become an effective leader, it is important to understand the core leadership theories from which leadership styles emerge and evolve. Cherry [14] identified eight core leadership theories; and these, together, with those discussed by Uzohue, Yaya and Akintayo [15], are briefly explained below.

- Great man theory

  This theory assumes that the capacity for leadership is inherent in someone, with great leaders being born and not made. Eckmann [16] found that this theory has its roots in Greek mythology, in which a leader is portrayed as being heroic in nature, rising up to meet the duties of leadership when needed [15].

- Trait theory

  This theory is similar to that of the great man theory: it assumes that some people inherit qualities and traits from their ancestors and from how they were raised that make them better suited to leadership [14]. Trait theory assumes that the effectiveness of a leader is based on certain common characteristics that leaders should have. Uzohue *et al*. [15] identified some of these traits as honesty, intelligence, persistence, competence, ambition, integrity, the ability to inspire, confidence, and responsibility.

- Behavioural theory

  Behavioural theory represents the opposite of the great man theory: it postulates the idea that great leaders are made and not born. Behavioural theory states that people can learn to become great leaders by training and from observing other great leaders [15].

- Participative theory

  This leadership style is embedded in the trait of incorporating the input of others into the decision-making processes. This type of leader encourages participation and contributions from team members and, by doing so, allows team members to feel relevant and committed to the decision-making process [14]. This type of leadership encourages the collaboration of the whole team, thus ensuring that better decisions are made [15].

- Contingency theory

    Uzohue *et al*. [15] explain contingency theory as that which is focused on examining the environment first, and thereafter choosing a particular style of leadership that is best suited for the particular work situation. Cherry [14] states that no single leadership style is appropriate in all situations, with variables such as leadership style, qualities of followers, and situational features contributing to the success of a task. Contingency theory therefore bases effective leadership on the degree of fit between a leader's qualities and leadership style and the requirements of a specific situation [15].

- Situational theory

    The situational theory concept states that leaders should choose a particular leadership style that is best suited to the situational conditions. As different leadership styles may be more appropriate for different situations, the leader is expected to adopt a wide range of leadership styles that must be at their disposal. Thus the situational theory is better suited to experienced leaders. While situational theory and contingency theory are similar, the main difference is that, in contingency theory, the leadership style should match the right situation, whereas in situational theory, the leader should adapt their style to the situation at hand.

- Transactional theory

    As stated by Bass [9], transactional leaders ensure that their subordinates meet commitments to the leader and/or the organisation by means of contingent reinforcement. When employees are able to meet their obligations successfully, transactional leaders impose rewards and praise; however, when employees under transactional leadership are unable to meet their commitments, they are reprimanded or punished in the form of negative feedback, reproof, or disciplinary action [15].

- Transformational theory

    Transformational leadership theory focuses on the relationship between the leaders and the followers. This leadership style's foundation is the process in which the leader engages with their followers so that connections can be created and the motivation and morality of both the leader and the follower increases [15]. Transformational leaders are able to motivate followers so that they can move beyond their own self-interest in order to ensure that the goals of the organisation are met [9].

2.2.2 Leadership styles

A leadership style illustrates a leader's specific behaviour, which is often influenced by their aims, personality, and interaction with their followers [17]; it is the *"manner and approach of providing direction, implementing plans and motivating people"* [18]. Leadership style is developed from leadership theories [19], and often different leadership styles are used, depending on the environment, situation or need of a leader [12].

Lewin, Lippitt and White [20] conducted the first major study of leadership styles, and identified three major leadership styles: the autocratic leadership style, the democratic leadership style, and the laissez-faire leadership style. In autocratic leadership, the leader is responsible for making all the decisions, and the followers are responsible for executing those decisions. In a democratic leadership style, decisions are made by both leaders and followers, and leaders fully engage with their employees [21]. In the laissez-faire leadership style, the leader allows the followers to make most of the decisions, while the leader is still responsible for the decisions; this therefore requires a great deal of trust between the leader and their followers [12].

Using the leadership styles proposed by Lewin *et al*. [20], Likert and Likert [22] postulated the difference between a job-centred leadership style, in which leadership focuses solely on work facilitation and measures goals, and an employee-centred leadership style, in which the leader emphasises the needs of employees and the importance of developing relationships [21].

Kibbe [12] adds that, since the development of leadership theories, numerous leadership styles have been identified. The most common, apart from those mentioned above, are described briefly below:

- Bureaucratic leadership — in this style leaders ensure that work is performed 'by the book' and that subordinates follow the rules and procedures rigorously and precisely.

- Charismatic leadership — this leadership style inspires enthusiasm in the team, and such leaders are often engaging and energetic in motivating a team to reach its goals.

- People-oriented leadership — in this style of leadership, the leader is completely focused on supporting and developing people in the team, putting people before the tasks at hand.

- Task-oriented leadership — this style of leadership focuses solely on getting a task/job done, and is goal-oriented as opposed to people-oriented.

- Servant leadership — in this style, leaders often do not see themselves as the leader, but rather as an individual who is required to meet the needs of the team as a whole. A servant leader aims to achieve the goals that are set, with the team receiving the recognition and glory as opposed to themselves.

2.2.3 Leadership models

A leadership model serves to help understand what makes great leaders, providing a framework for how to become a better leader [17]. It gives an example of how to lead and, unlike a leadership style, it does not take into account a leader's personality. Leadership models emerge from leadership theories and often influence leadership styles. Unlike leadership theories and styles, there is no frontrunner leadership model in the literature, with models and styles found to be used interchangeably.

2.3 Leadership 4.0: Leadership in the Fourth Industrial Revolution

In his address at the World Economic Forum Annual Meeting held in 2016, Professor Klaus Schwab importantly stated: "We need leaders who are emotionally intelligent, and able to model and champion co-operative working. They'll coach, rather than command; they'll be driven by empathy, not ego. The digital revolution needs a different, more human kind of leadership" [2]. 'Leadership 4.0' is a term coined for those leading the Fourth Industrial Revolution and digital transformation in their organisations. These leaders were identified by Bawany [23] as those "who can build teams, keep people connected and engaged, and drive a culture of innovation, risk tolerance, and continuous improvement".

In a study by Oxford Leadership, the attributes of a leader needed in 4IR were empathy, compassion, high creativity, and high social intelligence, as well as a high level of self-awareness [24]. Herder-Wynne, Amato and de Weerd [24] emphasised the need for leaders to have the ability to engage and motivate their team on an emotional level — qualities that the technologies of 4IR lack. Furthermore, given the exponential speed at which 4IR is occurring, leadership today needs to develop executive future-thinking skills so that they are better equipped to navigate the complexity and rapidness in which business is conducted [25] in 4IR. The ability of leaders to become more self-aware, and the focus on leaders displaying high emotional intelligence, are also needed to aid in them dealing with the stress brought upon by the high pace at which 4IR operates [24].

4IR places great emphasis on the need to develop innovative cultures [24]; thus leaders needs to steer their organisation with a "cross-hierarchical, team-oriented, and cooperative approach, with a strong focus on innovation" [11]. This is done by leaders creating a 'safe environment' in which subordinates are able to express their creativity and ideas freely by allowing the principle of 'fail fast' and learning through failure.

2.4 Leadership 4.0 models

As the study of Leadership 4.0 is an emerging topic, only three different Leadership 4.0 models have been found in the literature so far, which are explained below.

2.4.1 The 4.0 leadership style matrix model

Oberer and Erkollar [11] developed the '4.0 leadership style matrix'. This two-dimensional matrix displays the best-suited leadership approach for organisations, based on their degree of innovation orientation and people-leading requirements, which are reflected on each of the axes.

The matrix is divided into four quadrants, with each displaying a specific leadership style, as described below.

- 4.0 Freshman leader — this leadership style focuses on the manufacturing processes and the development of final products. Concern for the welfare of employees and for technology and innovation are of less importance to this type of leader.

- 4.0 Social leader — this leadership style focuses mostly on employee engagement and welfare. The creation of a sociable working environment is of greater importance than the emergence of new technology and innovation in this leadership style.

- 4.0 Technology leader — this leadership style emphasises the delivery of new technologies and intensifies the focus on innovation. A people focus is of less importance to this leader.

- 4.0 Digital leader — this leadership style places great importance on technology, innovation, and people. This leader is able to discern how technology impacts employees and ensures that the organisational model is both people and technology orientated.

2.4.2 Leadership 4.0 personas model

In another study, four different personas were identified that leadership needs for 4IR in order to deal with society, strategy, technology, and talent [26]. Referred to as 'social supers', 'data-driven decisives', 'disruption drivers', and 'talent champions' [26]. these leadership personas are described as follows:

- Social supers — this type of leadership persona considers societal initiatives to be essential to their business model in 4IR. These leaders show a genuine commitment to improving society, both within and beyond the organisation, and emphasise these beliefs ahead of financial performance.

- Data-driven decisives — these leaders are able to harness the big data that 4IR provides for strategies for the future that ensure the long-term survival and success of the organisation.

- Disruption drivers — these are the leaders who promote investment in technology and innovation. The boldness in technology selection made by such leaders allows organisations to be trend setters in Industry 4.0.

- Talent champions — these leaders focus on ensuring that their workforce is adequately trained and supported for the Industry 4.0 way of operation.

Deloitte [26] states that, by adopting such personas in their leadership, organisations are better suited to handle the complex and nimble nature of 4IR.

2.4.3 The new networked leader model

Stanton Chase (an executive search firm) highlights that the identification and recruiting of skilled leaders is of great importance in 4IR [27]. Thus they have proposed a leadership model known as 'the new networked leader'. The new networked leader has both traditional and agile leadership traits, is able to think in diverse ways, and ensures ethical responsibility. Stanton Chase elaborates further on the four aspects of this model [27]:

- Traditional leadership — while a new leadership approach is required for 4IR, Stanton Chase finds that previous leadership skills are still required. These traditional leadership skills, including the ability to lead, manage, and inspire others, are still considered a minimum requirement for a 4IR leader.

- Diversity — the ability to thrive in a diverse environment, including embracing a varied collection of opinions, perspectives, and backgrounds, is a requirement for a 4IR leader. By embracing diverse thinking and diverse environments, leaders are better able to enhance their knowledge and understanding of issues, thus enabling them to make good decisions at great speed.

- Agile leadership — agility in an organisation has five facets: innovating, performing, reflecting, risking, and defending, all of which are essential to the success of a leader. Agile leadership includes a leader's ability to lead a multi-generational workplace, as well as the ability to adapt to the varying needs of an ever-changing workforce.

- Ethical responsibility — a cornerstone of 4IR is the blurring of the boundaries between the physical, digital, and biological spheres, with the human/machine interface being a key feature of 4IR. Thus a 4IR leader must be able to address controversies ethically, such as technological advancements in human genetics and the labour rights in relation to AI, while drawing boundaries between the different spheres of 4IR.

However, while there is ample literature on leadership, and the literature on Leadership 4.0 is slowly emerging, there is a complete absence of studies on what leadership model, styles, and traits are required of a 4IR leader in the petroleum industry. This study aimed, therefore, to fill that gap by identifying the leadership style that is needed to best support 4IR in the petroleum sector.

3 CONCEPTUAL MODEL

In order to build the conceptual model, the authors developed a conceptual framework to illustrate the breakdown of the study and to indicate the different leadership theories and factors influencing each phase of the study — i.e., organisations pre-4IR, organisations transitioning to 4IR, and organisations fully functioning in 4IR. The model places the different leadership styles in context throughout the phases of transition to 4IR. It serves as a structured approach to both the research and building a model to understand the results. The conceptual model was designed in such a way that it addresses each of the research questions. By covering all three transitional facets, the model is designed to address the main research goal, which is to establish the changes required in leadership in order to best support 4IR, by answering all the research questions.

3.1 Fundamental facets of the model

The conceptual model is made up of the three phases that are required to determine the leadership changes that will have to be incorporated to support 4IR in the South African petroleum industry. These phases are:

- Leadership pre-4IR — in order to determine the leadership changes to be incorporated, one must first gauge the style, approach, and theories used prior to 4IR.

- Leadership transitioning to 4IR — as most organisations in South Africa are currently still transitioning to the 4IR way of business, this phase must be considered. During this volatile time, the leadership traits of the old and the new ways will be required; and it is in times of change that effective leadership is needed the most.

- Leadership in 4IR — these are the leadership styles, traits, and characteristics required successfully to lead an organisation that is operating fully in 4IR, and that constitute the outcome of the study.

In each phase there are factors of influence that, in turn, determine the needed leadership models and theories.

3.2 Emergent leadership characteristics obtained from the model

The model was designed to determine emergent, obsolescent, and unchanging leadership characteristics throughout the three phases that form part of the study.
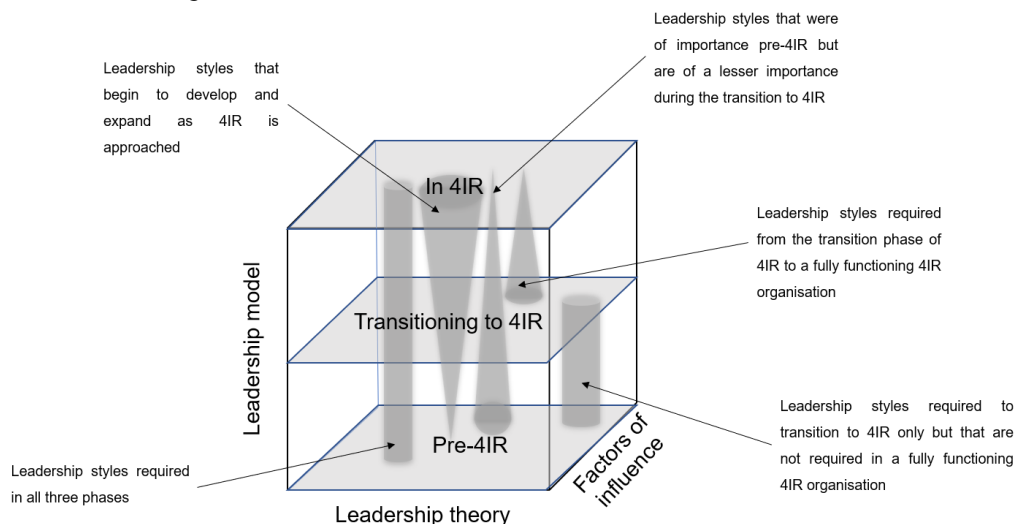This model is shown in Figure 1.

Figure 1: Illustration of emergent, obsolescent, and unchanging leadership styles in this study

3.3 Research answers obtained from the model

In addition to the model being designed to determine emergent, obsolescent, and unchanging leadership characteristics throughout the three phases that form part of the study, the conceptual model also aimed to answer the research questions shown below in Figure 2.
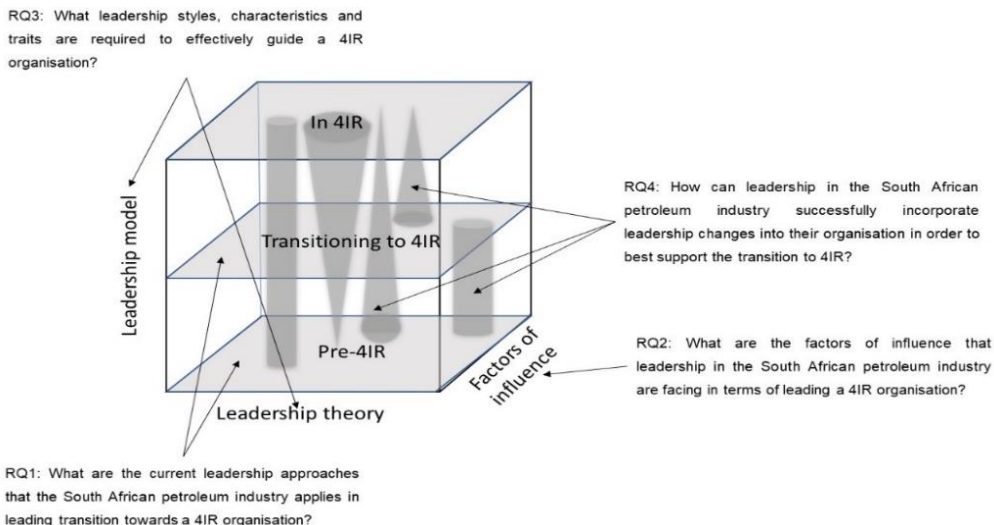

Figure 2: Illustration of how the conceptual model aims to answer the research questions

4   RESEARCH METHOD

The type of research conducted in this study was exploratory, using a qualitative approach. By employing qualitative research methods, an understanding was obtained of the leadership styles and techniques currently adopted by leaders, and of which leadership styles they believe to be best suited for 4IR. In order to achieve this understanding and to answer the research questions, a structured online survey was sent to employees who held leadership positions in the South African petroleum industry. In addition to the online survey, findings from the literature were also used in obtaining the results of the study.

5   RESULTS AND DISCUSSION

The questionnaire was sent out to 105 individuals in leadership roles in the South African petroleum industry. Of these individuals, 45 participated in the study, with 35 completing the entire questionnaire. The results and discussion presented in the ensuing sections comprise the data gathered from those respondents who completed the entire questionnaire, thus giving the survey a 33% response rate. Being a qualitative study that used a purposive sampling method, this return percentage is used to establish a trend in understanding, and is not a statistical distribution of the opinion in the industry at large.

5.1 Organisation's 4IR status

As organisations in the South African petroleum industry are at different phases in adopting 4IR technologies, it was necessary to determine the phase of 4IR in which the respondents' organisations were. The responses showed that none of the respondents was from a fully functioning 4IR organisation; and further investigations found that no organisations in the South African petroleum industry were in fact fully functioning as 4IR organisations. While 71 per cent of the respondents stated that their organisation was transitioning to 4IR, 29 per cent of the respondents felt that their organisation had not yet adopted 4IR technologies. Thus it can be concluded that the data gathered and reported on in the sections that follow is based on a majority of respondents who belong to organisations that are transitioning to 4IR. However, as the survey was based on all three phases of 4IR, the respondents were asked to answer the questions applicable to their organisations' current phase as well as the other two phases, thus acquiring their opinion on all three phases. As none of the individuals stated that their organisations were fully in 4IR, they answered the survey questions for this stage based on their belief of what was best applicable in this phase.

5.2 Leadership theories

Respondents were asked to rank the best applicable theory to each of the three phases that formed part of the study, from which the related styles and models could be identified.

A summary of the results is shown below in Table 1, with the highest ranked theory for each phase highlighted. These rankings are discussed further in the paragraphs below.

Table 1: Leadership theories ranked according to most needed during each phase of the 4IR transition in the South African petroleum industry

Leadership theory	Leadership characteristic	Ranking		
		Pre-4IR	Transition to 4IR	In 4IR
Great man	Leaders are born and not made	2	7	6
Trait	Leaders should have common characteristics	1	8	7
Transactional	Reward/punishment approach	3	6	8
Behavioural	Leaders are made and not born	4	4	4
Participative	Use contributions from team members	7	1	3
Contingency	Examine environment before choosing leadership style	6	3	5
Situational	Match leadership styles and situations	5	2	2
Transformational	Follower relationships are paramount	8	5	1

5.2.1 Leadership theory applying to the pre-4IR phase

The three highest-ranked leadership theories (in descending order) for pre-4IR were found to be the trait theory, the great man theory, and the transactional theory. The trait and great man theories separate the leader from the group: the leader adopts an air of superiority, as such theories instil the belief that leaders are the 'chosen ones' and that not everyone can be a leader. The transactional theory leads to a transactional leadership style that gives high importance to order, structure, and hierarchy. Transactional leaders lead their followers by issuing direct orders — a style that suits military-type operations in which the leader is highly experienced in subjects of which subordinates have no or little experience.

As mentioned previously, a range of different leadership styles are found in the literature, all of them arising from leadership theories. Taking into account the leadership styles mentioned earlier in this paper, it can be seen that the trait, great man, and transactional theories can give rise to an authoritarian, task-orientated (job-centred), and bureaucratic leadership style. In these types of leadership style, the leader makes most of the decisions for the team, thus creating a low level autonomy within the group. As 29 per cent of the respondents in the research survey indicated that their organisation had not yet adopted 4IR technologies, it can be concluded that these leadership styles are still used by some leaders in the South African petroleum industry.

5.2.2 Leadership theory applying to transitioning to the 4IR phase

Most of the South African petroleum industry is in the transition phase to 4IR. In this phase, the three highest-ranked leadership theories (in descending order) were the participative, situational, and contingency theories. In the participative theory, the leader is characterised by including all followers in the decision-making process and encouraging contributions from all of the team members to those processes, with the primary trait of this leader being inclusiveness. This theory gives rise to the democratic leadership style, in which decisions are made by both leaders and followers, and in which leaders fully engage with their employees. As in any transition phase, the learning curve in this phase is the highest for all involved; thus the participative theory is found to be the most needed one, as it involves the entire team in manoeuvring through uncharted territories. The situational and contingency theories focus on the leader changing their leadership style, based on the situation that confronts them. As numerous different leadership styles are mentioned in the literature, no particular leadership style is singled out for such theories. However, these theories highlight the need for leaders to have a wide range of leadership styles at their disposal, obtained from past and current experience, in order to lead effectively through the transitioning phase to 4IR.

5.2.3 Leadership theory applicable to being in the 4IR phase

While none of the respondents who were part of the research survey indicated that their organisation was operating fully within the 4IR, they did state their beliefs about which leadership theories best applied to a fully functioning 4IR organisation. The findings from this study indicate that, while the transformational theory was rarely used by leaders pre-4IR, it emerged in the transitioning phase to 4IR and was catapulted to the highest-ranked theory to be chosen when leading a 4IR organisation. This was followed by the situational and participative theories, which emerged as the second- and third-highest ranked theories. The transformational theory's foundation is the relationship between leaders and followers, with the leaders engaging with their followers to create connections that motivate the performance of both. The transformational theory gives rise to the transformational, people-orientated, charismatic, and servant leadership styles. In such styles leaders provide inspirational motivation to their followers, considering the uniqueness of the members of each team and providing suitable coaching and encouragement based on this, and also providing intellectual stimulation, and encouraging and developing a creative and safe space. As mentioned previously, the situational and participative theories require that the leader have a wide range of leadership styles in their arsenal on which they can draw, based on the varying circumstances that the agile nature of 4IR introduces.

5.2.4 Leadership theories' importance in the progress from pre-4IR towards 4IR

Based on the results, Figure 3 depicts how the core leadership theories vary in importance in the progress from pre-4IR through the transition phase to full 4IR status. The transformational theory quickly emerges as an organisation moves from pre-4IR, transitions to 4IR, and then operates as a fully 4IR organisation, while the great man, trait, and transactional theories become less important during these phases. It also shows that, while the behavioural, participative, contingency, and situational theories emerge in the transition phase to 4IR, they are required to a lesser extent in a fully 4IR organisation.
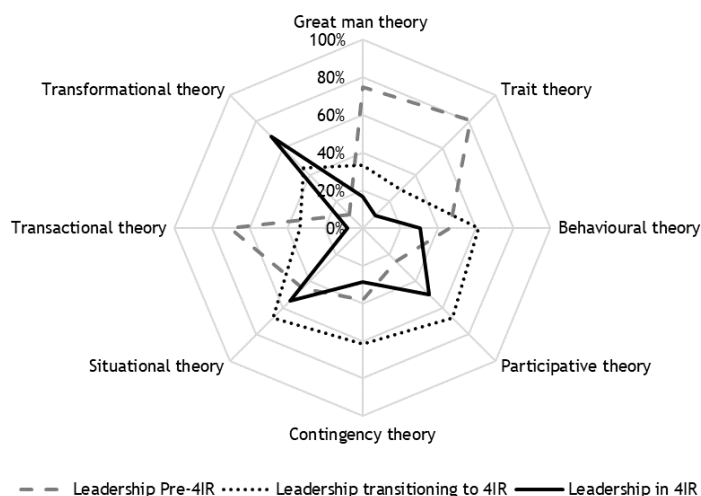

Figure 3: Trend of emerging leadership theories in each of the three phases of 4IR in organisations

5.3 Factors influencing leadership

Different factors influence the leadership style employed in the three phases of 4IR in the petrochemical industry. These factors were extracted from the literature and refined in the research survey. A summary of the results for these factors is given in Table 2, showing their indicated ranking in the survey, and is discussed below. The cells that are empty and so do not have a ranking were not deemed to have an influence on the pertinent phase.

Table 2: Factors influencing the leadership style in each phase of moving to 4IR in the South African petrochemical industry

Influencing factor	Ranking		
	Pre-4IR	Transition to 4IR	In 4IR
Economic climate	1		
Socio-political factors	2	6	8
Environmental factors	3		
Corporate social responsibility	4	7	7
Young talent retention	5		
Reskilling of employees		1	
Introduction of human/machine interfaces		2	
Demand for renewable energy sources		3	6
Rapid technology advances		4	1
Manual to AI control		5	5
Ethical use of AI and technological advances			2
Innovative working environments			3
4IR-skilled workforce			4

5.3.1 Factors influencing leadership in pre-4IR phase

Two factors emerging from this study as having the greatest impact on the type of leadership style pre-4IR were the economic climate and socio-political factors. Socio-political factors also had an impact on the transitioning and fully 4IR operating phases. As a developing nation, the blue-collar workforce in South Africa is often regarded as the backbone of manufacturing and the production of goods. In such a climate, in which innovation and creativity are not at the forefront, a bureaucratic and transactional leadership style is often employed. Furthermore, socio-political factors in South Africa were also found to be one the greatest influences on leadership styles pre-4IR, shown by the authoritarian leadership style emerging as one of the most frequently used styles in pre-4IR. This is because South Africa is a relatively new democracy, still unlearning the authoritarian leadership style imposed by previous governance regimes for many years. As stated previously, the authoritarian, bureaucratic, and transactional styles emerge from theories that are best suited to work structures and situations in which leadership activities of rigidity, repetitiveness, and hierarchical control are required. The factors that significantly influence the leadership styles pre-4IR show why such theories seem to be most applicable.

5.3.2 Factors influencing leadership in transitioning to 4IR

Although the transition-to-4IR phase has many influences, the two top-ranked factors influencing the leadership style were the reskilling of employees and the introduction of human/machine interfaces. In such an environment, the authoritarian, bureaucratic, and transactional leadership styles, which discourage creativity, flexibility, and group input, would not be of benefit. However, elements of them would remain because of the transitional culture. The participative theory, which gives rise to a democratic leadership style, with its primary trait of inclusiveness, was deemed to be best applicable to this phase. 4IR requires the reskilling of employees in the petroleum industry, as it introduces a move from reliance on manual operators to reliance on AI; thus leaders have to communicate with, engage with, and listen to employees who might feel anxious about their job security and career development in times of AI — illustrating why a democratic leadership style is needed. Furthermore, the reskilling of employees and the introduction of human/machine interfaces further indicate that this is a period of great change; and so the different working environments that come with it will warrant a range of different leadership styles to be employed, in line with the situational and contingency leadership theories.

5.3.3 Factors influencing leadership inside the 4IR phase

The two top factors influencing leadership in the 4IR were found to be technology advancing at an exponential rate and the ethical use of AI amid those technological advances. Given those rapid advances, an inspirational environment in which creativity is at its core is needed. This is provided by a transformational leadership style, which arises from the transformational leadership theory. Furthermore, as 4IR distinguishes itself from other revolutions by the rate at which technology advances, it requires leaders who can adapt constantly to different situations and communicate effectively with all stakeholders. This also indicated why the situational leadership theory was also deemed to be important. When considering the ethical use of AI and technological advances, leaders in organisations need to take mitigating action to ensure that machines do not harm people, as well as mechanisms to ensure that AI systems are not developed beyond human understanding of their complexity. The ethical aspects of AI also include respecting and ensuring privacy, security, and the sovereignty of private information and personal dignity. Thus a leadership style that is people-orientated rather than task-orientated is needed, as well as leaders who are able to coach, encourage, and look out for the development of their followers by adopting the transformational style. Both the situational and the transformational styles emerge from the transformational leadership theory.

5.4 Leadership models

5.4.1 Leadership 4.0 personas model

Respondents were asked to rank each of the Leadership 4.0 personas models in order of those most needed for the transition phase to 4IR and the fully functioning 4IR organisation. The results showed that, while disruption drivers are needed in the transition phase of 4IR, as an organisation becomes a fully functioning 4IR organisation, greater importance is placed on talent champions and social supers, as detailed below.

Leadership 4.0 personas in the transition phase of 4IR

The findings of this study indicate that, during the transition phase to 4IR, the data-driven decisives persona is deemed to be of the highest priority in a leader. This could be attributed to the need for the leader in this phase successfully to incorporate the changes that 4IR provides while maintaining a long-term view of the organisation and ensuring that the ongoing success of the organisation is kept in mind. Such a persona fits into the situational theory, as the leader needs to fulfil his or her role both in the transitioning phase and in the long-term fully operating 4IR phase. The disruption driver persona was also found to be important in this phase, as it requires leaders who promote investment in technology and innovation so that they make bold decisions when choosing technologies, thus allowing the organisation to emerge as a trendsetter in 4IR technologies. This type of persona requires a democratic leadership style, in line with the participative theory because, in order to make such bold technology choices, the leader needs the opinion and support of their followers. The talent champion persona emerged as the third most popular choice for the transitioning phase, in which the reskilling of employees is an influencing factor in the leadership style that is used. It is concluded that the social super persona ranks last because the transition phase is geared towards ensuring the survival of the organisation. Only once this is guaranteed can the leadership focus more on societal initiatives.

Leadership 4.0 personas in 4IR

According to the Leadership 4.0 personas model, it was found that the persona best applicable to a 4IR organisation was a talent champion. Talent champions focus on ensuring that their employees are trained and supported when running a 4IR organisation. This falls under the transformational theory, which puts the betterment of followers at the forefront. The data-driven decisive persona was found to be the second most popular choice for a leader in a 4IR organisation, showing that the need for leadership to have a long-term vision and strategy in mind is of utmost importance. Social supers rose from being the least popular choice in the transition phase to 4IR to be the third most popular choice in a 4IR organisation. This indicates that, once leadership fully transitions to 4IR ways of working, greater emphasis will be placed on societal initiatives both inside and outside the organisation; and that is deemed to be of importance for a leader functioning in line with the transformational leadership theory. Disruption drivers were found to be the least popular persona in a fully operating 4IR organisation. This could be attributed to the major technological choices being made in the transition phase, while leaders are more comfortable with the new technologies in a fully operating 4IR organisation.

5.4.2 The new networked leader model

Respondents were asked to select which traits and characteristics in the new networked leader model were either likely or unlikely to be needed in the transition phase to 4IR and in a fully functioning 4IR organisation. The results showed that the need for agile leadership was of equal importance both in the transition phase to 4IR and in a fully operating 4IR organisation, while ethical responsibility was more likely to be needed in a fully functioning 4IR organisation than in the transition phase. Diversity, while still

deemed to be important in both phases, along with traditional leadership, became less popular as organisations pass through the transition phase to 4IR.

*The new networked leader in the transition phase of 4IR*

In the transition phase of 4IR, leaders require the trait of agility the most so that they can adapt to and manage their ever-changing workforce. This connects with the situational and contingency theories that were highlighted earlier. The second most important trait was found to be that of diversity — that is, a leader embracing a varied collection of opinions, perspectives, and backgrounds in their leadership approach; this connects with the participative theory of leadership. Ethical responsibility was found to feature third on the list of the new networked leader in transitioning to 4IR. The factors influencing this behaviour and leadership style the most in this phase are the reskilling of employees and moving from a reliance on manual operators to a reliance on AI. Last, elements of traditional leadership were found still to be required in the transition phase of 4IR, as traditional leadership skills, including the ability to lead, manage, and inspire others, are considered a bare minimum for a leader, irrespective of the phase they are in.

The new networked leader in 4IR

The need for agile leadership, as promoted in the new networked leader model, was still found to be of great importance in a fully functioning 4IR organisation. As technology continues to change at an exponential rate throughout 4IR, agile leadership traits will be needed, in keeping with the situational theory. Ethical responsibility rose to second position, based on the traits and behaviours needed by a leader according to the new networked leader model. This could be attributed to the increased blurring of boundaries between the physical, digital, and biological spheres, in which the human/machine interface forms the cornerstone of this revolution. Thus a people-orientated leadership style, arising from the transformation theory, is deemed to be necessary. Diversity dropped to third position, in line with the new networked leader model in a fully operating 4IR organisation; however, it should be noted that the ability of a leader to use diverse thinking skills and to lead in diverse environments is still strongly required in a fully 4IR organisation, and is in keeping with the situational theory. In contrast, the traditional leadership traits associated with an authoritarian leadership style were deemed to be of even less importance in an operating 4IR organisation than in the transition phase.

5.4.3 The 4.0 leadership style matrix

The 4.0 leadership style matrix was the only leadership model that was found to be applicable in organisations that are fully operating with 4IR technologies. Thus the respondents were asked to rank each style in the model based on which they thought would be needed for their organisation when fully functioning in 4IR. The cumulative scores (Figure 4) were plotted on the 4.0 leadership style matrix to illustrate the leadership styles required in a fully 4IR organisation, taking into consideration a simultaneous concern for people and for innovation and technology.
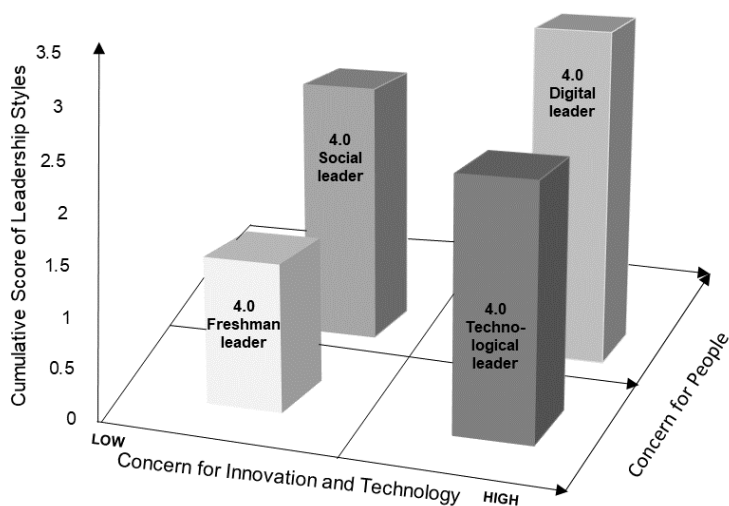
Figure 4: Cumulative score of leadership styles from respondents plotted on the 4.0 leadership style matrix

6 CONCLUSIONS AND RECOMMENDATIONS

From the results and the discussion, it was concluded that the research objectives were achieved on the basis of the following key conclusions:

- Most of the South African petroleum industry is currently in the transitioning phase to 4IR, in which a democratic leadership style, arising from the participative leadership theory, was deemed to be most applicable to lead effectively in this phase. The major factors influencing the leadership style in this phase are the reskilling of employees and the introduction of human/machine interfaces. This requires adequate communication and engagement within the team, which a democratic leadership style encourages.

- In this transition phase, a multitude of different scenarios is expected to arise, requiring leaders to be aware of and use different leaderships styles that best suit a particular situation.

- Leadership theories such as the great man, trait, and transactional theories, from which authoritarian, bureaucratic, and task-orientated leadership styles originate, proved to be the most popular leadership styles pre-4IR. However, in the transitioning phase to 4IR, and then when operating fully in 4IR, the use of these theories and hence their styles was found to be less necessary. Thus, in order best to support the transition phase to 4IR and to lead effectively in a 4IR organisation, leaders need to move away from authoritarian, bureaucratic, and task-orientated leadership styles.

- The leadership theory identified as being most applicable to leading a 4IR organisation was the transformational theory, which steadily emerged through the three phases. From this theory, leadership styles such as transformational, people-orientated, and charismatic emerge, with their focus on the relationship between leaders and followers, in which leaders engage with their followers, connections can be created, and the motivation and morality of both the leader and the follower increase.

- While new models are being developed in the literature to illustrate the leadership styles, traits. and characteristics of the kinds of leader that are required for 4IR, it can be concluded that the leadership styles that are best suited to 4IR are all based on the transformational theory of leadership.

This study thus concludes that, in order for South African petroleum industry leaders to thrive in 4IR, they must move away from the leadership styles that have emerged from the great man, trait, and transactional leadership theories, such as the authoritarian, bureaucratic, and task-orientated leadership styles. In the transition phase of 4IR, leaders should embrace a democratic leadership style, communicating and engaging with their followers and adding different leadership styles to their personal arsenal that would be best suited to these dynamic times. Once organisations in the South African petroleum industry begin to operate fully in 4IR, transformational, people-orientated, and charismatic leadership styles should be at the forefront, placing a great emphasis on connections and engagement between leaders and followers, and ensuring the strongest human-to-human connections in the age of AI.

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