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THE DETERMINANTS OF FOURTH INDUSTRIAL REVOLUTION LEADERSHIP DEXTERITY: A PROPOSED FRAMEWORK FOR 4IR-INTELLIGENCE AND SUBSEQUENT 4IR LEADERSHIP DEVELOPMENT

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ABSTRACT

Civilisation finds itself at the dawn of a revolution considered to be the Fourth Industrial Revolution (4IR). The introduction of new business models, the disruption of sectors and the reshaping of socio-economic systems are all evidence of the profound changes taking place across all industries, unlike previously experienced in history. From the premise of the evident leadership challenges and opportunities inherent to 4IR, this position paper propagates a 10-type intelligence framework (Fourth Industrial Revolution Intelligence Framework), consisting of Contextual Intelligence (CI), Emotional Intelligence (EI), Inspired Intelligence (II), Physical Intelligence (PI), Entrepreneurial Intelligence (EntI), Strategic Intelligence (SI), Transdisciplinary Intelligence (TI), Ecosystem Intelligence (EcoI), Socratic Intelligence (SocI), and, Ethical Intelligence (EthI). The intent of the framework is for leaders to develop and apply the 10-type intelligence proposition in order to adapt, shape and harness the potential of disruption brought about by 4IR. Applying critical interpretive synthesis, previous scholarly text and Winston and Paterson's (2006) 'Integrative Definition of Leadership' was used as basis for evaluating the leadership schema through the lens of 4IR. The resultant framework could serve as leadership developmental agenda, as well as create greater awareness of 4IR and setting a valuable foundation from where further research can be undertaken.

1. INTRODUCTION

When observing contemporary leadership through the lens of the profound changes taking place across all industries, numerous challenges become apparent on a macro-, mezzo, and micro level. In terms of the world of work for example, Lorenz, Rüßmann, Strack, Lueth, and Bolle (2015:3) are of the view that a workforce transformation is on the horizon because of technological advancement; collectively known as "Industry 4.0." Schwab (2016) also postulates that humankind finds itself at the beginning of a revolution he considers to be the "**Fourth Industrial Revolution"** (**4IR**), and observes that "in its scale, scope, and complexity, the transformation will be unlike anything humankind has experienced before." 4IR is evolving at an exponential rate, not only changing the "what" and the "how" of doing things but also "who" we are, as we experience the transformation of entire systems, across (and within) countries, companies, industries and society. Schwab (2016) further states that although it is not clear how it will unfold, it is of necessity that the "response to it must be integrated and

comprehensive, involving all stakeholders of the global polity, from the public and private sectors to academia and civil society."

Considering the evident challenges and opportunities inherent to 4IR, Schwab (2016) subsequently calls for the mobilisation of the collective wisdom of people's minds, hearts and souls to adapt, shape and harness the potential of disruption. The leadership imperative in this call is evident; however, if leadership is about influencing others to accomplish common objectives and directing an organisation in ways to achieve cohesiveness and coherency (Sharma & Jain, 2013:310), the question then beckons, how should it be done to navigate 4IR? Lord, Dinh and Hoffman (2015:264) contest that the future offers many potentialities, which they define as "alternative states and possible outcomes that could occur but have not yet occurred because, to be actualised, they require the enactment of individual, social, and environmental events that are often serendipitous." Consequently, leadership could be regarded as the requisite "active agent" in the realisation of this enactment. But at the individual level of analysis, what would a leader require to lead in 4IR characterised by unprecedented complexity and uncertainty?

Drawing on Winston and Paterson's (2006) "Integrative Definition of Leadership" which was the result of a study that uncovered over 90 variables that may comprise the whole of leadership, this conceptual paper sets out to investigate leadership through the lens of 4IR by applying Critical Interpretive Synthesis, and to propose a framework for "4IR-Intelligence" to serve as 4IR leadership development agenda.

2. PROBLEM INVESTIGATED

Technological advancement is increasingly transforming the way we work, live, communicate, travel and socialise, which, at the rate it is going, could fundamentally alter life, as we know it. So profound could it be that Kurzweill (2005:22) predicts a future period during which the pace of technological change will be so rapid, its impact so deep, that human life will be irreversibly transformed. Humankind finds itself in an age of unprecedented digital technological progress, which will continue to improve, bringing about not only beneficial transformations, but also profound challenges, likely to bring economic disruption (Schwab, 2016). It is very plausible that as computers get more powerful, companies will have less need for some categories of employees (Brynjolfsson & McAfee, 2014:9-11), thereby accentuating the challenges of leadership. Increasingly, machine algorithms are applied in intellectual tasks that were once the exclusive domain of humans, and both ends of the occupational spectrum (high- and low-

end) are likely to be impacted as software automation and machine learning advances (Ford, 2013:37-38).

Most technologies that will have a big impact on the world in five or ten years from now are already in limited use, while technologies that will reshape the world in less than fifteen years probably exist as laboratory prototypes (Bostrom, 2014:4). Although many are still in early stages of development, they are already introducing an inflection point as they build on and amplify each other in a synthesis of technologies across the physical, digital and biological worlds (Schwab, 2016).

This dramatic increase in development of technology and its impact on life in its broadest terms can thus not be negated, which puts leadership at the centre of the paradox of beneficial transformations and profound challenges. However, how should leaders position themselves for a future of exponential automation across the various sectors of the economy? How should leadership practice evolve to navigate the anticipated disruptions to organisations and associated impact on the social fabric? Chui, Manyika, and Miremadi (2015) posit that the organisational and leadership implications are profound and that, from leaders to front line managers, will need to redefine jobs and processes to ensure organisational longevity.

3. RESEARCH OBJECTIVES

Against this backdrop, the objectives of this conceptual paper are threefold: Firstly, to investigate leadership through the lens of 4IR; secondly, to propose a 4IR-Intelligence framework for leadership developmental purposes; and thirdly, to create greater awareness of 4IR amongst scholars and practitioners.

4. LITERATURE REVIEW

4.1 The 4IR landscape

The rapid technological advancement that is increasingly transforming the way we work, live, and communicate, fundamentally altering our lives day by day appears to contrast contemporary leadership. Thus, leadership in the wake of technology's exponential advancement should be of particular importance to scholars and practitioners. This section's aim is therefore to review the state of technological advancements, and how it relates to leadership.

Bostrom (2014:255) states that we find ourselves in an era of strategic complexity, characterised by uncertainty. Albeit that many considerations have been determined, their details and interrelationships remain unclear and dubious, and there might be other factors we have not even considered yet. Brynjolfsson and McAfee (2014:9-11) refer to three broad conclusions, namely (1) finding ourselves in a time of profound digital technological progress, (2) the potential benefits to be brought about by digital technology, and (3) the potential thorny challenges brought about by digitisation; emphasising that it should not be surprising, as "even the most beneficial developments have unpleasant consequences that must be managed" (Brynjolfsson & McAfee (2014:11). The World Economic Forum (2015:5) identified six software and services megatrends which are shaping society, namely (1) people and the internet, (2) computing, communications and storage everywhere, (3) the Internet of Things, (4) artificial intelligence (AI) and big data, (5) the sharing economy and distributed trust, and (6) the digitisation of matter.

In terms of the world of work, Lorenz *et al* (2015:5) lists the top ten effects of industry 4.0 on the workforce as being (1) big-data driven quality control, (2) robot-assisted production, (3) self-driving logistic vehicles, (4) production line simulation, (5) smart supply network, (6) predictive maintenance, (7) machines as a service, (8) self-organising production, (9) additive manufacturing of complex parts, and (10) augmented work, maintenance, and service.

Although there's never been a better time to be a worker with special skills or the right education Brynjolfsson and McAfee (2014:11) contest that the technological progress could leave many people behind, because computers, robots, and other digital technologies are acquiring ordinary skills and abilities at an extraordinary rate.

A more optimistic argument by Stewart, De and Cole (2015:1) highlight how technology has led to overall job creation in the past. The direct effects are that technology substitutes labour, raising productivity and lowering prices, and sectors which are the source of technological innovation expand rapidly, demanding increased labour. The indirect effects are that technology complements labour, leading to improved outcomes in sectors which subsequently expand and generate new demand for labour. In addition, lower costs of production and prices enable consumers to shift spending to more discretionary goods and services, generating new demand for labour (Stewart *et al.*, 2015:1)

Although senior managers are far from obsolete, machine learning is progressing at a rapid pace, and executives need to become adept in creating innovative new organisational forms

needed to manage in an age of machine intelligence; accentuating creative abilities, leadership skills, and strategic thinking (McAfee, Goldbloom, Brynjolfsson & Howard, 2014).

It is, however, evident that predictions about the future development of technology, such as artificial intelligence, are as self-assured as they are diverse, and whether value can be extracted from the breadth and diversity of predictions is questioned (Armstrong, Sotala & ÓhÉigeartaigh, 2014:317). The research of Armstrong *et al.* (2014) highlights the problems with expert judgement, in theory and in practice, and that timeline predictions prove to be mostly unreliable, generally containing little useful information.

Nevertheless, the dramatic increase in development of technology and its impact on leadership practice in the future cannot be negated, but coupled to that, the way in which knowledge is being constructed in relation thereto also proves to be lacking scientific rigour and subsequent leadership practice implications.

4.2 The Leadership Foundation

The topic of leadership has fascinated people for centuries, with as many definitions as there are differences (Kreitner & Kinicki, 2004:595); hence remaining a somewhat elusive concept difficult to define precisely. Evidently the disagreement on the definition of leadership is mainly because it involves a complex interaction among the leader, the followers, and the situation.

Because of this fragmentation, this study draws on the work of Winston and Paterson (2006) who conceptualised an integrated framework for leadership following their study that identified over 90 variables that may comprise the whole of leadership. The essence of their integrated definition is summarised in the 23 points (page number in brackets) below (*ibid.*):

1. “A leader is one or more people (8)
2. who selects, equips, trains, and influences (9)
3. one or more follower(s) who have diverse gifts, abilities, and skills (10)
4. and focuses the follower(s) to the organisation’s mission and objectives (11)
5. causing the follower(s) to willingly and enthusiastically expend spiritual, emotional, and physical energy (12)
6. in a concerted coordinated effort to achieve the organisational mission and objectives (13)
7. The leader achieves this influence by humbly conveying a prophetic vision of the future in clear terms that resonates with the follower(s) beliefs and values (14)

8. such that the follower(s) can understand and interpret the future into present-time action steps (15)
9. In this process, the leader presents the prophetic vision in contrast to the present status of the organisation (16)
10. and through the use of critical thinking skills, insight, intuition, and the use of both persuasive rhetoric and interpersonal communication including both active listening and positive discourse, facilitates and draws forth the opinions and beliefs of the followers (17)
11. such that the followers move through ambiguity toward clarity of understanding and shared insight (20)
12. that results in influencing the follower(s) to see and accept the future state of the organisation as a desirable condition worth committing personal and corporate resources toward its achievement. (20)
13. The leader achieves this using ethical means and seeks the greater good of the follower(s) in the process of action steps such that the follower(s) is/are better off as a result of the interaction with the leader. (20)
14. The leader achieves this same state for him/herself as he/she seeks personal growth, renewal, regeneration, and increased stamina – mental, physical, emotional, and spiritual – through the leader-follower interactions. (21)
15. The leader recognizes the diversity of the follower(s) and achieves unity of common values and directions without destroying the uniqueness of the person. (21)
16. The leader accomplishes this through innovative flexible means of education, training, support, and protection (22)
17. that provide each follower with what the follower needs within the reason and scope of the organisation's resources and accommodations relative to the value of accomplishing the organisation's objectives and the growth of the follower. (23)
18. The leader, in this process of leading, enables the follower(s) to be innovative as well as self-directed within the scope of individual-follower assignments and allows the follower(s) to learn from his/her/their own, as well as others' successes, mistakes, and failures along the process of completing the organisation's objectives. (24)
19. The leader accomplishes this by building credibility and trust with the followers through interaction and feedback to and with the followers that shapes the followers' values, attitudes, and behaviours towards risk, failure, and success. (25)
20. In doing this, the leader builds the followers' sense of self-worth and self-efficacy such that both the leader and followers are willing and ready to take calculated risks in making decisions to meet the organisation's goals/objectives and through repeated process

steps of risk-taking and decision-making the leader and followers together change the organisation to best accomplish the organisation's objectives. (27)

21. The leader recognises the impact and importance of audiences outside of the organisation's system and presents the organisation to the outside audiences in such a manner that the audiences have a clear impression of the organisation's purpose and goals and can clearly see the purpose and goals lived out in the life of the leader. (28)
22. In so doing, the leader examines the fit of the organisation relative to the outside environment and shapes both the organisation and the environment to the extent of the leader's capability to insure the best fit between the organisation and the outside environment. (29)
23. The leader throughout each leader-follower-audience interaction demonstrates his/her commitment to the values of: (a) humility, (b) concern for others, (c) controlled discipline, (d) seeking what is right and good for the organisation, (e) showing mercy in beliefs and actions with all people, (f) focusing on the purpose of the organisation and on the well-being of the followers, and (g) creating and sustaining peace in the organisation – not a lack of conflict but a place where peace grows." (30)

Utilising the above exhaustive delineation of leadership as foundation, the next section introduces intelligence as paradigm to further augment the leadership schema in 4IRs context.

4.3 The "intelligence" paradigm

Schwab (2016) argues that the challenges of 4IR can only be meaningfully addressed if the collective wisdom of people's minds, hearts and souls are mobilised. To do so, Schwab (2016) contests the need to adapt, shape and harness the potential of disruption by nurturing and applying four different types of intelligence, namely, contextual (the mind), emotional (the heart), inspired (the soul), physical (the body). Oosthuizen (2016) expanded on Schwab's (2016) proposition through the addition of entrepreneurial intelligence (as disposition type of intelligence), thereby increasing the potential of realisation of real impact and value creating solutions. Thus, how we recognise opportunity through synthesis of the whole and creative combination of resources.

But what is intelligence? Legg and Hutter (2007) compiled a collection of 71 definitions on intelligence (18 collective definitions, 35 psychologist definitions, and 18 AI researcher definitions). One of the earliest definition citations by Legg and Hutter (2007:20) is that of Binet and Simon (1905) that states "It seems to us that in intelligence there is a fundamental faculty, the alteration or the lack of which, is of the utmost importance for practical life. This faculty is

judgement, otherwise called good sense, practical sense, initiative, the faculty of adapting one's self to circumstances." According to Belohlavek (2007:11), intelligence research identified the use of three layers to support human adaptive behaviour, describes as (1) Reactive Intelligence, which has direct contact with the environment; (2) Active Intelligence, which sustains reactive intelligence when there is a need for a planning process; and (3) Ontointelligence, which sustains active intelligence when the "apprehension" of the essence of a certain reality is required.

Piaget (1963) in Legg and Hutter (2007:22) states that "intelligence is assimilation to the extent that it incorporates all the given data of experience within its framework. There can be no doubt either, that mental life is also accommodation to the environment. Assimilation can never be pure because by incorporating new elements into its earlier schemata the intelligence constantly modifies the latter in order to adjust them to new elements."

For purposes of this study Gottfredson (1997) definition in Legg and Hutter's (2007:19) is adopted, i.e. "Intelligence is a very general mental capability that, among other things, involves the ability to reason, plan, solve problems, think abstractly, comprehend complex ideas, learn quickly and learn from experience."

5. RESEARCH METHODOLOGY

The nature of the research problem (unprecedented digital technological progress bringing about beneficial transformations, but also profound challenges, likely to bring economic disruption), the diverse elements thereof (e.g. AI, biotechnology, nanotechnology, 3D-printing, decision-making automation, robotics, IoT), its interconnectedness and multi-dimensionality (the way we work, live, communicate, travel and socialise) led to the application of critical interpretive synthesis (CIS) (Dixon-Woods, Bonas, Booth, Jones, Miller, Sutton, Shaw, Smith & Young, 2006:38).

The literature on 4IR-related topics and themes is large, diverse, and complex, including both qualitative and quantitative empirical work; editorial commentaries and theoretical work; case studies; evaluative, descriptive, sociological, psychological, management, and economics papers. Subsequently, a conventional systematic review methodology was deemed ill-suited to the challenges that conducting such a review would pose, and CIS was decided upon.

Dixon-Woods, Kirk, Agarwal, Annandale, Arthur, Harvey, Hsu, Katbamna, Olsen, Smith, Riley and Sutton (2005:6) posit that CIS starts with an ambiguous and tentatively defined

phenomenon; conducts extensive albeit not complete searching; strategically samples from the literature; conducts appraisal and critique of the included literature and, through a process similar to primary qualitative research, aims to produce a theoretical output in the form of a synthesised argument. Otherwise explained by Bales and Sare (2014:144) as (1) formulating the review question, (2) searching the literature, (3) sampling, (4) determination of quality, (5) data extraction, and (6) interpretive synthesis. According to Dixon-Woods *et al.* (2006:39) CIS explicitly sanctions the integration of qualitative and quantitative evidence through an interpretive process.

A distinguishing feature of CIS is its recognition of the authorial voice in that it does not lay claim to a set of techniques that allows a 'reproducible' synthesis. Instead, the interpretive work required to produce an account of disparate forms of evidence is acknowledged, and it appreciates that alternative accounts of the same evidence might be possible using different authorial voices. However, all accounts should be grounded in the evidence, verifiable and probable, and that reflexivity will be a principal requirement (Dixon-Woods *et al.*, 2006:39).

In terms of formulating the review question in this study, the approach was highly iterative, modifying the question in response to search results and findings from retrieved literature. Searching the literature, generated extensive potentially relevant items, proving to be unmanageable, and subsequently only potentially relevant literature was identified to provide a sampling frame. For purposes of the synthesis, purposive sampling was initially applied to select literature that were clearly concerned with aspects of 4IR, partly informed by the scoping running up to the study. Sampling therefore involved a constant dialectic process conducted concurrently with concept generation.

As far as determination of quality is concerned, literature that appeared relevant was prioritised, rather than particular study types or literature that met specific methodological standards; hence the application of a low threshold was utilised to maximise the inclusion and contribution of a wide variety of literature at the conceptual level. Data extraction concerned systematically identifying themes pertinent with leadership within the 4IR context and the very recent findings of Schwab following the World Economic Forum meeting in Davos, Switzerland where 4IR was the featuring topic. In conducting the interpretive synthesis, a detailed inspection of the literature was the point of departure, gradually identifying recurring themes and developing a critique. Themes were then generated to help develop an argument, comparing the argument developed against the literature, and attempting to specify the reasoning and the relationship with the argued proposition.

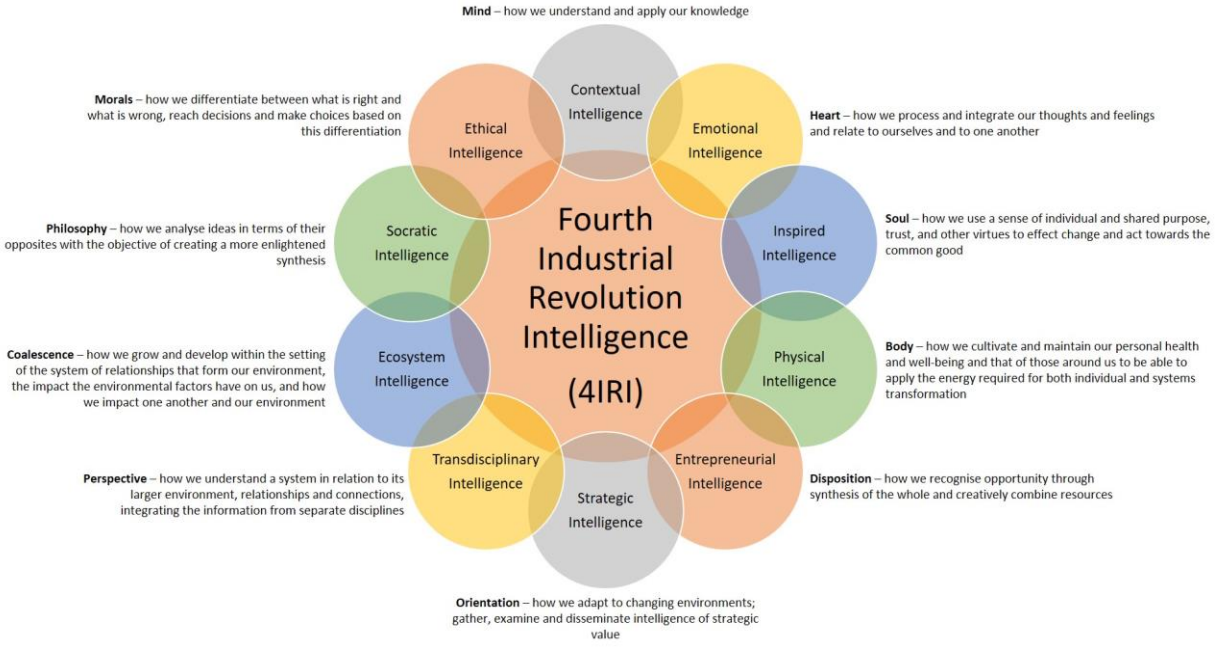
6. RESULTS

This position paper further expands on the intelligence types of Schwab (2016), i.e., contextual-, emotional-, inspired-, and physical intelligence, and Oosthuizen (2016), i.e., entrepreneurial intelligence to include strategic-, transdisciplinary-, ecosystem-, socratic- and ethical intelligence to create a ten-factor intelligence type framework, namely:

1. contextual (the mind) – how we understand and apply our knowledge (Schwab, 2016)
2. emotional (the heart) – how we process and integrate our thoughts and feelings and relate to ourselves and to one another (Schwab, 2016)
3. inspired (the soul) – how we use a sense of individual and shared purpose, trust, and other virtues to effect change and act towards the common good (Schwab, 2016)
4. physical (the body) – how we cultivate and maintain our personal health and well-being and that of those around us to be in a position to apply the energy required for both individual and systems transformation (Schwab, 2016)
5. entrepreneurial (the disposition) – how we recognise opportunity through synthesis of the whole and creative combination of resources (Oosthuizen, 2016)
6. strategic (the orientation) – how we adapt to changing environments (Wells, 2012); gather, examine and disseminate intelligence of strategic value (Djekic, 2014).
7. transdisciplinary (the perspective) – how we understand a system in relation to its larger environment, relationships and connections, bringing the information from separate disciplines together to create useful knowledge (Montuori, 2013:47).
8. ecosystem (the coalescence) – how we grow and develop within the setting of the system of relationships that form our environment, the impact the environmental factors have on us, and how we impact one another and our environment (Bloom & Dees, 2008:47).
9. socratic (the philosophy) – how we analyse ideas in terms of their opposites with the objective of creating a more enlightened synthesis (Chaffee, 2013:62).
10. ethical (the morals) – how we differentiate between what is right and what is wrong, reach decisions and make choices based on this differentiation (Rich, 2013:4).

A conceptual 4IR intelligence framework is subsequently proposed, i.e., Contextual Intelligence (CI) + Emotional Intelligence (EI) + Inspired Intelligence (II) + Physical Intelligence (PI) + Entrepreneurial Intelligence (EntI) + Strategic Intelligence (SI) + Transdisciplinary Intelligence (TI) + Ecosystem Intelligence (EcoI) + Socratic Intelligence (SocI) + Ethical Intelligence (EthI) = 4IR Intelligence (4IRI). Figure 1 below provides a schematic representation of the framework.

Figure 1: Fourth Industrial Revolution Intelligence Framework



Source: Author's own construction

For purposes of operationalisation, each of the intelligence types are discussed below:

6.1 Contextual intelligence (CI)

From a perspective of a contextual sub-theory of intelligence, Sternberg (1985:45) views intelligence as "mental activity directed toward purposive adaptation to, and selection and shaping of, real-world environments relevant to one's life." The situation in which purposeful action is taken is thus emphasised, Brown, Gould and Foster (2005:51) posit that contextual intelligence (CI) has to do with practical know-how that transcends what is formally described or taught directly, requiring understanding of the context in which one functions; not only knowing what to do, but also knowing how to get it done.

Similarly, Kutz (2008:23) defines contextual intelligence as "the ability to quickly and intuitively recognise and diagnose the dynamic contextual variables inherent in an event or circumstance and results in intentional adjustment of behaviour in order to exert appropriate influence in that context." Context has to do with the nature of relations and interdependencies among and between agents (e.g., people, ideas, values, experiences, cultures, etc.), political alliances, organisations, religious alignment, social contexts, and private context. Therefore, contextual

intelligence refers to the awareness of these interactions between agents that fundamentally inform behaviour in a social complex environment (Kutz & Bamford-Wade, 2013:67)

Tarun (2014:60), arguing that insufficient attention has been paid to context in the field of management, further adds that contextual intelligence is “the ability to understand the limits of our knowledge and to adapt that knowledge to an environment different from the one in which it was developed.” Schwab (2016) furthers that “sense of context is defined as the ability and willingness to anticipate emerging trends and connect the dots. These have been common characteristics of effective leadership across generations and, in the fourth industrial revolution, they are a prerequisite for adaptation and survival.”

Consequently, it is imperative that management practitioners understand the value of diverse networks across traditional boundaries, and develop their capacity and readiness to engage with all stakeholders related to the matter at hand. To acquire a holistic view of the situation, management practitioners have to pursue a multi-stakeholder orientation that transcends the increasingly counterproductive boundaries between sectors and professions. In addition, the capability to reframe mental and conceptual models and organisational philosophies is essential. Leaders failing in this will find it challenging to adjust to the disruptions of 4IR (Schwab, 2016).

6.2 Emotional intelligence (EI)

Goleman (2004:82) argues that one common trait most effective leaders share, is a high degree of emotional intelligence. In fact, he regards it as the sine qua non of leadership; without it, even the best training in the world, an incisive, analytical mind, and an endless supply of smart ideas, still won't make a great leader. Salovey and Mayer (1990:189) define emotional intelligence as "the subset of social intelligence that involves the ability to monitor one’s own and others’ feelings and emotions, to discriminate among them and to use this information to guide one’s thinking and actions."

According to Goleman (2004:88) emotional intelligence consists of five components, namely, (1) Self-Awareness (ability to recognise and understand your moods, emotions, and drives, as well as their effect on others), (2) Self-Regulation (ability to control or redirect disruptive impulses and moods; the propensity to suspend judgment - to think before acting), (3) Motivation (passion to work for reasons that go beyond money or status; a propensity to pursue goals with energy and persistence), (4) Empathy (ability to understand the emotional makeup of other people; skill in treating people according to their emotional reactions), and

(5) Social Skill (proficiency in managing relationships and building networks; an ability to find common ground and build rapport).

With reference to manager and leadership qualities, Lazovic (2012:798) argues that a high degree of emotional intelligence manifests in developing positive relations and achieving emotional commitment from employees, which strengthens organisational culture, improves its resilience and increases its flexibility. Developing a culture of trust grows synergy among employees which in turn stimulates creativity; essential for developing novel solutions and shaping innovative responses to the increasingly complex demands of contemporary society – as characterised by 4IR.

At the heart of emotional intelligence is the adaptation of creating conscious and intelligent actions regarding one's own emotional responses as well as managing other people's reactions to a particular situation. Of importance, however, is the ability to first understand one's own emotional state and subsequent recognition of its impact on one's behaviour (Lazovic, 2012:799). Scwab (2016) contests that self-awareness, self-regulation, motivation, empathy and social skills are critical skills to succeed in the era of 4IR. The level of emotional intelligence and the capacity to cultivate it continuously evidently differentiates the outstanding decision-makers from the average ones, and organisations rich in leaders with high emotional intelligence will be more creative and better equipped for agility and resilience in this age of persistent and acute change, able to cope with disruption.

6.3 Inspired intelligence (II)

Derived from the Latin word 'spirare' (to breathe), Schwab (2016) coined the term 'inspired intelligence' which refers to the continuous search for meaning and purpose. Schwab (2016) furthers that it emphasises nurturing the "creative impulse and lifting humanity to a new collective and moral consciousness based on a shared sense of destiny."

Aligned with this view, previous research illuminates articulating a vision as an essential leadership act (Gupta, Macmillan & Surie, 2004:246; Stopper, 2005:6). Sumner, Bock and Giamartino (2006:44) emphasise the importance of envisioning the future by imagining exciting and worthy possibilities. Being forward-looking – envisioning exciting possibilities and enlisting others in a shared view of the future – is the attribute that most distinguishes leaders from non-leaders (Kouzes & Posner, 2009:20). It also influences follower trust because leaders show followers an attractive vision of the future to persuade them to believe in their own prospects (Chen, Hwang & Liu, 2009:129). Sumner *et al*. (2006:44) further posit that

organisations are not successful through the actions of a single person; it requires a team effort, trust and strong relationships, competence and confidence, collaboration and individual accountability.

Horwitch and Whipple (2014:2) also accentuates the ability to energise people, foster engagement and creating trust; inspiring the team and extending it all the way to the front line. The science of leadership has provided strong support for the notion that inspired intelligence infuses a vision for the future that speaks to shared concerns of the collective (Molenberghs, Prochilo, Steffens, Zacher & Haslam, 2015:2). Leaders thus need to portray a collective-oriented vision for the future by engaging with a higher order collective identity between them and their followers (Molenberghs *et al.*, 2015:3). Schwab (2016) posits that sharing is key, and leaders need to shift the focus from the self to a universal sense of common purpose. Unless a sense of shared purpose is developed collectively, addressing the challenges and reaping the full benefits of 4IR will not be possible.

6.4 Physical intelligence (PI)

According to Postle (1989) physical Intelligence is concerned with fitness and health, enjoyment of physical activities, pride in manual skills and dexterity, sensible and balanced diet, love of the outdoors, and good at household tasks. Schwab (2016) contests that physical intelligence involves "supporting and nourishing personal health and well-being." This, Schwab (2016) argues, is critical due to the accelerated pace of change, increased complexity and increased number of stakeholders involved in decision-making processes. The need to keep fit and remain calm under pressure therefore becomes all the more important.

Covey (2004:41) asserts that "scientific laboratory studies are producing increasing evidence of the close relationship between body (physical), mind (thinking) and heart (feeling)[emotions]." In a study on the effects of physical activity on cognitive functioning in middle age, Singh-Manoux, Hillsdon, Brunner, and Marmot (2005:2255) also found that physical activity has a beneficial impact on cognitive functioning.

Schiller (2013:47) emphasises the importance of physical intelligence, stating that it does, however, not only refers to a high level of fitness, either muscular strength/endurance or anaerobic threshold and nutrition. Instead, Schiller (2013:47) argues, the intent of deepening physical intelligence is to enhance self-mastery, which Majer, Jason, an Olson (2004:59) describes as "a perception that reflects one's personal mastery or control over life outcomes."

This view is supported by scientific research, with epigenetics, a field of study in biology, shows undeniably the vital importance of sleep, nutrition and exercise in our lives, and understanding ways of keeping one's physical body in harmony with one's mind, one's emotions, and the world at-large is imperative (Schwab, 2016).

6.5 Entrepreneurial intelligence (EntI)

Entrepreneurial has to do with how we think, reason and act in relation to value creating opportunities in our local, national and global environment. Timmons and Spinelli's (2009:101) defines entrepreneurship as "a way of thinking, reasoning, and acting that is opportunity obsessed, holistic in approach, and leadership balanced for the purpose of value creation and capture."

Cuervo, Ribeiro and Roig (2007:4) posit that entrepreneurship is a central element for economic progress as it manifests its fundamental importance in different ways: a) by identifying, assessing and exploiting business opportunities; b) by creating new companies and/or renewing existing ones by making them more dynamic; and c) by driving the economy forward – through innovation, competence, job creation and by generally improving the wellbeing of society. Wiklund, Davidson, Audretsch and Karlson (2011:4) proposes that the phenomenon of "emergence of new economic activity" lies at the heart of entrepreneurship, which resonates with Timmons and Spinelli's (2009:101) view that entrepreneurship results in the creation, improvement, realisation, and renewal of value for all stakeholders. Key to the process is the recognition of opportunities (thinking and reasoning), followed by the will and initiative to seize these opportunities (act).

Entrepreneurial intelligence is thus the ability to recognise opportunity through synthesis of the whole and creatively combining resources that result in the creation or renewal of value that makes economic and/or social meaning. The significance to 4IR is that entrepreneurship transcends the classic start-up notion to include companies and organisations of all types, in all stages; thus, including organisations that are old and new; small and large; fast and slow growing; in the private, not-for-profit, and public sectors; in all geographic points; and in all stages of a nation's development, regardless of politics (Timmons and Spinelli's, 2009:101). It is further significant because it supports Douglas' (2003:62) proposition of a meta-model of the entrepreneurship phenomenon in that it considers the complexities of the domain of business enterprise and management as a whole – as it ranges from the macro-level socio-economic-political to the micro-level activities of the owner-manager-entrepreneur.

Entrepreneurial intelligent leaders can inject imagination, motivation, commitment, passion, tenacity, integrity, teamwork, and vision into 4IR, and despite facing dilemmas, ambiguity and contradictions, identify opportunities, influence solutions and create value.

6.6 Strategic Intelligence (SI)

Agha, Atwa and Kiwan (2015:65) emphasise the need for organisations to be flexible and act more intelligently with their environment because of the changing business landscape characterised by globalisation, computerisation, information technology, and changing purchasing patterns which make sustained competitive advantages difficult. Agha *et al* (2015:65) further highlights the need for strategic intelligence to enhance and maintain their performance in the current information age, arguing that the gathering of information, and turning raw data into intelligence through human judgment is a fundamental aspect of business.

McDowell (2009:17) states that strategic intelligence deals with overall trends that can be interpreted by evaluating a wide range of variables. It enables decision making that is specifically relevant to long-term planning, and also provides a means of supporting organisational objectives by considering perspectives of future challenges that, if regarded, directly impacts on current planning (McDowell, 2009:26). Wells (2012:3) refers to strategic intelligence as the ability and capacity to adapt to changing conditions and environments, instead of continuing blindly down a course when all the signals in the competitive environment suggest otherwise (Wells, 2012: 3).

According to Maccoby (2001) five interrelated competencies make up strategic intelligence, namely, foresight, systems thinking, visioning, motivating and partnering. Foresight is the ability to think in terms of trends that are not obvious and can't be measured but are shaping the future. Systems thinking has to do with the ability to synthesise elements of a system for the purpose of analysis. Visioning implies using foresight and systems thinking to shape a preferred future. Motivating is the ability to get people to embrace a common goal and to execute a vision. Lastly, partnering is the ability to form strategic alliances. Liebowitz (2006) further considers strategic intelligence as the conjunction and interaction of knowledge management, business intelligence and competitive intelligence.

Leaders with strategic intelligence understand the context in which they are leading (Maccoby & Scudder, 2011:33) and move their followers to become willing collaborators to the common good (Maccoby & Scudder, 2011:39). It is a methodical and ongoing process of gathering,

examining and disseminating intelligence of strategic value in an actionable way to assist in long-term decision-making (Djekic, 2014).

6.7 Transdisciplinary Intelligence (TI)

According to Montuori (2013:46) inquiry has traditionally approached all phenomena from the perspective of a single discipline, e.g. psychologists, might study the psychology of creativity, or leadership, and sociologists might study the sociology of work or gender. Albeit that disciplinary approaches have historically produced some excellent research Montuori (2013:46) argues, they are also limited and limiting. Not that such research is not interesting or important per se, but it provides only a partial view, and this view is often – despite limitation warnings – taken to be the whole. Using that partial view as a lens through which to view the entire phenomenon becomes problematic, particularly for practitioners. Unlike academic disciplines, life (and 4IR for that matter) does not break down into neat categories and disciplines, and we ignore them at our own risk.

The deep cause of error is not error of fact (false perception), or error of logic (incoherence), but rather the way we organise our knowledge into a system of ideas (theories, ideologies) (Morin, 2008:2). Referring to the "pathology of knowing" and "blind intelligence" Morin (2008:3) accentuates the domination of principles of disjunction, reduction, and abstraction, which, together, he calls the "paradigm of simplification."

Transdisciplinarity is inquiry-driven rather than discipline-driven. In transdisciplinarity, scope is defined by the needs of the subject matter, not determined and guided by the boundaries of the discipline (Montuori, 2013:46). Nicolescu (2010:20) argues that transdisciplinarity concerns that which is at once between the disciplines, across the different disciplines, and beyond all disciplines. Its goal is the understanding of the present world, of which one of the essentials is the unity of knowledge. Nicolescu (2010:22) furthers that the methodology of transdisciplinarity is founded on three axioms: "(1) The ontological axiom: There are, in Nature and in our knowledge of Nature, different levels of Reality of the Object and different levels of Reality of the Subject. (2) The logical axiom: The passage from one level of Reality to another is insured by the logic of the included middle. (3) The complexity axiom: The structure of the totality of levels of Reality is a complex structure: every level is what it is because all the levels exist at the same time."

Citing Flyvbjerg (2001), Montuori (2013:47) furthers that "transdisciplinarity draws on systems and complexity theories to propose a way of thinking that is different from reductive/disjunctive

disciplinary thought. It requires thinking that contextualises, starting with the assumption that any system needs to be understood in terms of its larger environment and relationships, and connections, showing how to bring the information from separate disciplines together so that it can be useful knowledge that allows us to act wisely." Montuori (2015:196) states that our contemporary networked society, driven by the power of new technology, enables access to more information than ever before. The challenge, however, is how to organise that information, turn it into knowledge, and utilise that knowledge wisely, affirming that transdisciplinarity and complexity are ideas whose time has come.

6.8 Ecosystem Intelligence (EcoI)

Biologists discovered the limits of studying living organisms in isolation, and that they gained a much deeper understanding by considering the complicated relationships between organisms and their environments. They look not only at the impact that environmental factors such as soil and water have on organisms, but also at the impact that these organisms have on one another and their environment (Bloom & Dees, 2008:47). Drawing on the insights from ecology and using an ecosystems framework could enhance leaders' understanding of the process and phenomena playing out in 4IR.

Bloom and Dees (2008:47) argue that human societies are just as complex as ecosystems, with many different types of players and environmental conditions. According to Morin (2008:11) two main causes flow from the idea of an open system, namely (1) the laws of organisation of the living are not laws of equilibrium, but rather of disequilibrium, recovered or compensated, stabilised dynamics; and (2) that the intelligibility of the system has to be found, not only in the system itself, but also in its relationship with the environment, and that this relationship is not a simple dependence - it forms part of the system. Morin (2008:11) furthers that reality is therefore as much in the relationship as in the distinction between the open system and its environment – a relationship absolutely crucial epistemologically, methodologically, theoretically, and empirically.

Bateson (1987) conceptualised metaphorical bridges between that which happens in the ecological world and that which happens in human lives which Gilstrap (2011:37) refers to as human ecology; that which seeks to describe populations of societal coalescence around different sociological constructs. The term "ecosystem intelligence", therefore, brings these constructs together.

Johnson (2008:2) states that Bronfenbrenner (1989) developed his ecological systems theory in an attempt to define and understand human development within the context of the system of relationships that form the person's environment. According to Bronfenbrenner's initial theory (1989), the environment is comprised of four layers of systems which interact in complex ways and can both affect and be affected by the person's development, namely the microsystem, mesosystem, exosystem, and macrosystem. He later added a fifth dimension that comprises an element of time, namely chronosystem (Bronfenbrenner, 1995).

6.9 Socratic Intelligence (SocI)

In terms of Socrates' dialectic method of systematic inquiry (which continues to be the bedrock of philosophical thought) Chaffee (2013:8) describes it as continually analysing ideas in terms of their opposites with the ultimate goal of creating a more enlightened synthesis. Socrates would begin with a general definition of an important concept, and then use his dialectical method to seek an understanding of the essential nature of the central concept (Chaffee, 2013:62). Chaffee (2013:91) furthers that, using penetrating questions, Socrates' method insisted on the criteria of logical soundness, clear definitions, consistency, and freedom from self-contradiction.

According to the United Nations Educational, Scientific and Cultural Organization (UNESCO) (2007:34) Socrates regarded himself as intermediary, "helping students to develop their own ideas by carefully guiding the group's discussion through questions and interjections and by rephrasing different concepts, so as to develop a progressive and logical train of critical thought." Socrates' philosophy was rooted in concrete problems trying to find answers to seemingly simple questions. Dialogue about questions helped both Socrates and his dialogue partners to achieve 'practical wisdom'; such wisdom, and not the construction of a philosophical system being the aim of Socratic Dialogue (Wortel & Verweij, 2008:54).

Socrates insisted on (1) establishing clear starting points; (2) viewing issues from multiple perspectives; (3) exploring logical connections and the consequences of beliefs; (4) expressing publicly one's own thinking process and inviting others to respond; (5) being willing to follow the argument wherever it might lead; and (6) being open to revising one's opinions based on new insight (Chaffee, 2013:91).

The applicability to leadership in 4IR finds expression in the UNESCO (2007:164) view that Socratic dialogue is a philosophical practice for everyone, in which a small group of people led by a rigorous facilitator (leader) engage in dialogue over many hours in order to get to the

bottom of some fundamental question of general interest and find an answer. The term “socratic intelligence” thus refers to this ability.

6.10Ethical Intelligence (EthI)

As a philosophical discipline of study, Rich (2013:4) defines ethics as “a systematic approach to understanding, analysing, and distinguishing matters of right and wrong, good and bad, and admirable and deplorable as they relate to the wellbeing of and the relationships among sentient beings.” Ethics and leadership are organisational imperatives (Coyne, Bell & Merrington, 2013:27), and technological and scientific advances, socio-economic realities, diverse worldviews, and global communication (characteristic of 4IR) demands a leader to consider the ethical issues in the world community, their everyday lives, and the organisations they lead (Rich, 2013:3). Weinstein (2011:6) base ethical inteligence on five simple principles, i.e., (1) do no harm, (2) make things better, (3) respect others, (4) be fair, and (5) be loving; however, although we know these principles, they are difficult to live by.

Belohlavek (2007:15) defines ethical intelligence as “the intelligence that structures stable and dynamic rules that determine the action of the individual in his environment. It determines his capacity to add value, his influence on the environment and on others and his time management.” Ocreus (2016), in organisational terms, defines ethical intelligence as “the ability to recognise and respond appropriately and effectively to ethically challenging situations.” Their definition thus recognises what matters in a commercial organisation, i.e., the ability to recognise ethical matters, to make appropriate ethical decisions based on a robust set of facts, to communicate those decisions as ethical decisions and explain the underlying reasoning, and to persuade others and the organisation as a whole to accept and adopt those decisions.

According to Seider, Davies and Gardner (2009:214), individuals who demonstrate ethical intelligence recognise their role as members of a local, national and international community and consider the effects of their actions on these various communities. Belohlavek (2007:16) further argues that the higher the level of ethical intelligence, the higher the level of consciousness an individual needs to have. Therefore, the development of a leader’s ethical intelligence implies the increase of maturity which is based on higher levels of consciousness.

7. CONCLUSIONS

The 4IR megatrends which are shaping society promises not only beneficial transformations, but also profound challenges, likely to bring economic disruption. Subsequently, the organisational and management practice implications are profound, and leaders will need to redefine their management orientation to ensure organisational longevity.

Building on Scwab's pioneering work, it is subsequently proposed that the challenges of 4IR can only be meaningfully addressed if the collective wisdom of people's minds, hearts and souls are mobilised by nurturing and applying contextual-, emotional-, inspired-, physical-, entrepreneurial-, strategic-, transdisciplinary-, ecosystem-, socratic- and ethical intelligence.

Leaders need to develop their capacity and readiness to engage with all stakeholders in the context of their respective organisations. They have to acquire an integrated holistic view, by pursuing a multi-stakeholder orientation that transcends the increasingly counterproductive boundaries between sectors and professions.

In order to be creative and better equipped for agility and resilience in this age of persistent and acute change, able to manage the disruptions and resources in restricted times, leaders require high levels of emotional intelligence and the capacity to cultivate it. Leaders therefore need to shift the focus from the self to a universal sense of common purpose in order to address the challenges and securing the benefits of 4IR. In addition, leaders need to embrace the importance of sleep, nutrition and exercise, and understand ways of keeping their physical bodies in harmony with their mind, emotions, and the world at-large.

How leaders think, reason and act in relation to value creating opportunities in the local, national and global environment could extensively influence the probability of organisational longevity. In terms of 4IR, a leaders' habitual inclination should be the recognition of opportunities and subsequent actions to create value.

Leaders need to understand the context in which they are leading, and sharpen their ability and capacity to adapt to the changing conditions and environments inherent to 4IR. The need for developing their competencies of foresight, systems thinking, visioning, motivating and partnering is thus essential as they influence their followers to become willing collaborators to the organisational objectives. Any system needs to be understood in terms of its larger environment and relationships, and connections. As such leaders' thinking need to contextualise, drawing information from separate disciplines together so that it can be useful

knowledge that allows them to act wisely. It is thus imperative for a leader in 4IR to appropriately organise information, turn it into knowledge, and utilise that knowledge wisely.

Because human societies are just as complex as ecosystems, with many different types of players and environmental conditions, necessitates that a leader in 4IR considers not only the system itself, but also its relationship with the environment, understanding that this relationship is not a simple dependence, but forms part of the system. 4IR plays out as much in the relationship, as in the distinction between the open system and its environment. In getting to the bottom of some of 4IRs fundamental questions, leaders should hone the skill to facilitate regular dialogue with followers that elicits practical wisdom in finding answers of importance to the organisations sustainability.

Finally, leaders need to recognise their role as members of a local, national and international community and consider the effects of their actions on these various communities. They must have a deep sense of understanding in analysing and distinguishing matters of right and wrong, good and bad, and admirable and deplorable as it relates not only to their own thinking, reasoning and acting, but also that of their followers in the execution of the organisation's mission.

This position paper set out to investigate leadership through the lens of 4IR and to propose a 4IR-Intelligence framework for leadership developmental purposes. In this endeavour, greater awareness of 4IR and leadership implications amongst scholars and practitioners have also been created, setting an important benchmark from where further research can be undertaken.

8. RECOMMENDATIONS

Reflecting on the technology shifts fundamentally altering society it is evident that these components of 4IR have created an inflection point that are also redefining leadership. The volatility, uncertainty, complexity and ambiguity spawned by these 4IR shifts demand leaders to reinvent themselves, and the 10-type intelligence framework could serve as the ideal path for reinventing oneself and realigning oneself to meaningfully address the challenges and exploiting the benefits. Subsequently, the following practical recommendations proposed:

- At the individual level leaders should assess themselves in relation to the 4IR-Intelligence framework so as to determine their readiness and identify shortcomings.

- At the team and organisational level leaders should initiate developmental initiatives in relation to the 4IR-Intelligence framework so as to empower employees and followers to meaningfully contribute to addressing the challenges and exploiting the opportunities.
- At the organisational level leaders should give 4IR prominence in their organisations' strategic dialogue.

Reflection on, and development of the 10-type intelligence constructs individually and collectively could create a firm foundation from where to influence an unconstrained future with many possible beneficial outcomes.

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