

Leaders' views on leadership and skills development in the Fourth Industrial Revolution

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Orientation: The Fourth Industrial Revolution (4IR) is increasingly becoming a reality in organisations worldwide.

Research purpose: The aim of this article was to explore the views of international leaders on leadership and skills development in employees to equip them for the 4IR.

Motivation for the study: Leaders have to adjust their perspectives and leadership while the entire workforce is required to focus on their skills development on technological, individual and interpersonal levels.

Research approach/design and method: A qualitative research methodology is applied, using a phenomenological paradigm. Eight top leaders from Australia, India, Germany, South Africa, North America, the United Arab Emirates, and Singapore in various global and organisational fields were interviewed on leadership and skills development in the 4IR.

Main findings: Leaders focus on understanding and applying new technological trends, adopting a 4IR mindset, and developing skills through training and integrating systems. Additionally, they believe that skills development needs to include hard and soft skills, continuous training, and anticipating future trends. Skills need to have individual, interpersonal, organisational, societal and spiritual aspects to address the 4IR complexities adequately.

Practical/managerial implications: Leaders need to understand the complexes of the 4IR and need to train and support employees to develop themselves and their skills adequately.

Contribution/value-add: This article adds to the research on skill development, training and understanding future work trends to prepare leaders, industry and employees for future work trends and requirements for education for future work places.

Keywords: Fourth Industrial Revolution; global leaders; leadership; skills; talent, organisation.

*When everything seems to go against you,
remember that the airplane
takes off against the wind,
not with it.
Henry Ford*

Introduction

In the Fourth Industrial Revolution (4IR), which is described as a new technological era driven by technological innovation, especially from a Western point of view (Signé, 2023), strong leadership is a necessity. This new era influences the central aspects of every society, including education, business, politics and sociocultural factors (Liao et al., 2017; Peters, 2017; Schwab, 2017), and leads to radical changes in organisational and societal practices (Becker & Stern, 2016). Mayer and Oosthuizen (2021) have pointed out that many of the rapid changes in organisations are coupled with conscious and unconscious emotions such as anxiety and excitement, which influence changes and processes of the 4IR organisations. Simultaneously, general insecurities about the benefits and challenges (Xu et al., 2018) are abundant and often the 4IR is experienced as disruptive (Kruger, 2020). Took out sentence, as suggested.

Leaders as well as employees are challenged by the way in which organisations change rapidly and require services related to the technological advances of the 4IR, such as artificial intelligence (AI), the Internet of Things (IoT), advanced engineering, such as 3D-printing, machine learning, cyber-physical systems and robotics (Anshari, 2020), all while taking consumers and changing

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communication, production, and employment into consideration (Tsekeris, 2019). Alade, Windapa and Wachira-Towey (2021:74) highlight that 'leader functions of executing and coaching are not being employed' and that there are 'gaps in the perceived functions of leaders in implementing 4IR'.

Leaders in the 4IR need specific leadership styles to be successful and effective (Shapshak, 2019). They also need to apply a specific mindset – for example, one that is systemic, eco-centric (not egocentric), and which highlights leadership through networks rather than through structures, and which constructs leadership 4.0 through collective behaviour (Kelly, 2019). At the same time, it has been highlighted that specific skills are needed in the 4IR era to meet the complex requirements of technological advancement (Kamaruzaman et al., 2019). Besides the technological aspects, adaptive and flexible mindsets are needed (Gleason, 2018), while educational and training institutions need to adapt their education and training styles and processes to actively increase employees' skills, knowledge, learning, and abilities (Modise & Van den Berg, 2021).

However, there is very little research available on leaders who work in 4IR institutions and organisations, on their views of leadership appropriate to the 4IR, and what skills are needed to drive the 4IR forward constructively. Therefore, the aim of this research study was to explore leaders' views on leadership and skills in the 4IR. Accordingly, the researcher wished to investigate the perspectives of global organisational leaders effective and successful skills that are needed in a world, which is extremely complex, agile, effective and complicated (Morieux, 2018), and find out which skills these leaders propose should be developed in employees to meet the needs of the 4IR.

The purpose of this article is to contribute to the ongoing discourse on leadership and skill development in a world that is driven by 4IR processes of smart system development, robotics, machine to machine learning, and human-machine interaction. The article provides deeper insight into, understanding of, and increased guidance for leaders and employees in global 4IR processes.

Leadership in the Fourth Industrial Revolution

Leadership in the 4IR is often attributed to specific leadership styles or leadership attitudes. Examples of these are agile action, emotional intelligence, humble confidence, accountability, vision, courage, flexibility, technical aptitude, intuition, collaboration, quick learning abilities, cultural intelligence, authenticity, and focus (Giardino, 2019). A recent Japanese study highlights that creative thinking skills in particular can support leaders in changing policy and procedures within organisations to overcome 4IR challenges and create new opportunities (Almaloy, 2023). In his book about leadership 4.0, Kelly (2019) describes the new leadership needed in the 4IR as 'swarm leadership', meaning

it needs to relate to swarm organisational structures. These are highly collaborative networks with limited structure, governance and regulation, which need to be designed by benchmarking best practices, being interconnected and following the law of demand (Kelly, 2019, p. 85).

Furthermore, leaders need to take the ecological and organisational environment into consideration, introduce a vertical approach to developing leadership, and lead through networks while bearing in mind the collective mindset and behaviour (Kelly, 2019). Mdluli and Makhupe (2017) propose that leadership in the 4IR needs to combine several quotients of competencies such as emotional and intelligence quotients, a digital quotient, an agility and adaptability quotient, a sociocultural quotient, and creativity and innovation quotients. Emotional aspects of leadership are self-awareness, social skills, motivation, empathy and self-regulation, while the digital aspects include digital strategy, digital capabilities, and digital culture. In terms of the agility and adaptability quotient, leaders need to be innovative, performing, reflecting, risking and defending. Leaders also need sociocultural skills, which consist of the three interactive components of cultural knowledge, cross-cultural skills, and cultural metacognition. According to Mdluli and Makhupe (2017, p. 11), leaders need to be ethnographers who bring 'ethnography into leadership' in the organisation. Creativity and innovation are vital to 4IR leadership and can be dealt with using a design-thinking methodology, which is applied within the organisation.

However, in the Deloitte Review, Renjen (2019) points out that leaders seem to be less prepared to tackle the 4IR than they might think they are. The report observes that leaders seem to 'struggle to develop effective strategies in today's rapidly changing markets' (Renjen, 2019, p. 40), and are ambiguous in their approach to the 4IR. The report further identifies four types of leaders who are on a successful path forward. They are: (1) 'Social Supers' who are socially and ecologically orientated to product development, (2) 'Data-Driven Decisives' who use data to make decisions, (3) 'Disruptive Drivers' who invest in and create new technologies, and (4) 'Talent Champions' who have the needed skillset and are prepared to take responsibility.

Mayer and Oosthuizen (2020) found that international leaders highlight the importance of understanding individuals from different cultural backgrounds, having an open mindset, building on interpersonal connections, and creating a respectful and trusting environment. Furthermore, the leaders who participated in the study emphasised that they focus on positive emotions and cooperation, and value an empathetic, loving, and kind leadership culture. Tzavaras and Stelios (2022), who investigated Aristotelian virtues of leaders in the 4IR, found that for the 4IR leader in particular, digital 'virtues' need to be developed in the ethical realms of practical wisdom, fortitude (courage), temperance, and justice. However, it is not only leaders who need to develop their leadership; employees also need to develop their skills in general (Gorecky, 2014).

Skill development in the Fourth Industrial Revolution

Employees need support in dealing with the 4IR and developing their skills, according to industrial and organisational psychologists (Ghislieri et al., 2018). Singaram and Mayer (2022), coming from the same disciplinary field, have pointed out that the skill development of employees needs an ambitious and competitive organisational culture, which incorporates 4IR thinking, policymaking and motivation in leaders of organisations, while taking the broader societal contexts of the organisations into consideration. Previous studies have, at the same time, shown that organisations that invest in the development of their employees experience major losses because employees do not transfer the new skills and competences into their workplaces (Caravella & Menghini, 2018; Makridakis, 2017; Park, 2017).

Employees have a strategic role to play in organisations of the 4IR because it is they who determine organisational strategies, monitor production, and integrate systemic processes (Schawbel, 2015). Researchers notice that research is needed to explore the necessary employee skills, which need to be upgraded in the 4IR (Mkansi & Landman, 2021; Pfeiffer, 2015; Rapanyane & Sethole, 2020).

Various researchers have highlighted that employees must have new core skills to deal with the 4IR (Anakpo & Kollamparambil 2022; Asmal et al. 2020; Ayinde & Kirkwood 2020). For example, Motyl et al. (2017) state that employees need to be able to deal with virtual, augmented and real worlds, complex situations, and multifunctional teams. Ghislieri (2017) recognises that soft skills are extremely important, but points out that many employees do not realise that they need to use these skills in their work contexts.

Similarly, Anshari, Syafrudin and Fitriyani (2022) observe that employees need to focus on knowledge management and humanities during the 4IR. Anshari and Hamdan (2022) developed a critical view of 4IR employee skills, recommending that the existing 4.0 skills gap, skill evolution, machine knowledge, intuitive and rational decision-making, digital fluency, collaborative innovation, industrial policies and human-machine interaction, as well as societal systems, all need to be taken into account when focussing on employee skill development.

At the micro level, various authors advise that employees need to increase their ability to be able to address different challenges

and make their skills more unique (Ayinde & Kirkwood 2020; Hecklau et al., 2016). The 4IR requires broad intercultural skills, language competencies, flexibility, networking skills and understanding of processes (Hecklau et al., 2016). Thereafter, not only innovation skills, service orientation competences, but also the ability to transfer knowledge and tolerate ambiguity become increasingly important, as well as digital design knowledge and data literacy (Ntombela & Civilcharran, 2023). Chaka (2021) highlights that based on a meta-analysis of 4IR skills, generic soft skills are needed in combination with the 21st-century skills, such as communication, creativity, and problem-solving. In terms of hard skills, predominantly programming skills are needed. The author mentions that information literacy is usually under-represented and under-cited as a 4IR skill. Employees need to upskill increasingly virtual work competencies, information technology (IT) and IT security skills, complex process management, as well as technology management and data utilisation (Abe, Abe & Adisa, 2021; Hecklau et al., 2016). Finally, according to Hecklau et al. (2016), there will be a need for employees to learn to sustain the environment as well as themselves, protect resources and create sustainable solutions, in addition to retaining knowledge of political and legal standards, data security, and privacy. Based on their findings, Hecklau et al. (2016) developed skill sets that are foundational for the 4IR (see Table 1). These skill sets have, since 2016 been supported by other research studies, as shown above.

Besides the individual skills that are required by employees, Ivaldi et al. (2022) have highlighted that organisational learning and new practices are also needed to help the upskilling of employees and the organisation. According to the authors, a balance must be found between digital and physical, constraint and discretion, work and family life. Therefore, the work cultures are the 'key object to be shaped, nurtured, developed and shared' (Ivaldi et al., 2022, p. 11).

Research methodology

The study uses a qualitative research design (Flick, 2020), which is based on empirical data collection and analysis. The qualitative research paradigm used is phenomenological and aims at exploring and generating an in-depth understanding of leadership and skill development in a complex sociocultural environment (Flick et al., 2004). Based on the study, complex phenomena are addressed (Yin, 2016) and can be applied to management and leadership practices on a global level (Bennett 1991).

TABLE 1: Skill set.

Technical skills	Methodological skills	Social skills	Personal skills
State-of-the-art knowledge	Creativity	Intercultural skills	Flexibility
Technical skills	Entrepreneurial thinking	Language skills	Ambiguity tolerance
Process understanding	Problem-solving	Communication skills	Motivation to learn
Media skills	Conflict resolution skills	Networking skills	Ability to work under pressure
Coding skills	Decision-making	Teamwork skills	Sustainable mindset
Understanding of IT security	Analytical skills	Ability to compromise and cooperate	Compliance
	Research skills	Knowledge transfer skills	
	Efficiency orientation	Leadership skills	

Source: Hecklau, F., Galeitzke, M., Flachs, S., & Holger, K. (2016). Holistic approach for human resource management in industry 4.0, *Procedia CIRP*, 54, 1–6. <https://doi.org/10.1016/j.procir.2016.05.102>

Sample and sampling technique

The study was conducted with eight interviewees. The inclusion criteria for the sampling were defined (Yadav, 2022) as follows: (1) Being a global leader in an international organisation (top and middle management level), (2) working within an organisational context, which is 4IR-driven, (3) being English-speaking.

Interviewees were employed in the space industry, automotive industry, education, business management and IT services. Their cultural backgrounds were South African (1), German (1), Indian (2), North American (US) (1), Malaysian (1), Australian (1), and Moroccan (1) (see Table 2). Six interviewees defined themselves as male, two as female. All of them had been working in their industry for more than 10 years at the time of the interviews. Interviewees were selected using convenience and snowball sampling techniques (Etikan et al., 2016).

Data collection and analysis

In this research study, theoretical and methodological approaches were triangulated and integrated with the data collected (Creswell, 2013).

Data for this research study were collected through semi-structured interviews, which were tailored to the research questions described in the introduction (Barrett & Twycross 2018). Data were analysed through the systematic process of arranging and rearranging the interview transcripts, interpreting them, and understanding the phenomenon studied through thematic analysis (Braun & Clarke 2006). In thematic analysis, the researcher follows the foundational thought that the analysis is based on the researchers 'owning' their perspective, being reflexive and theoretically sensitive (Braun & Clarke 2023). In this study, thematic coding was used that led to categorisation and theme development, based on research values and the conceptualisation of key concepts such as the theme (Braun & Clarke 2023). The thematic analysis was further based on exploring themes as interpretative stories, which are built around uniting meaning (Braun & Clarke 2022). The stories presented in the findings and based on the analysis are diverse: They unify diversity and contrasting issues and are analysed and presented through the perspective of the researcher and their reflective practice (Folkes, 2022).

TABLE 2: Interviewee demographics.

No.	Cultural background	Gender	Field of expertise
Sampled interviewees			
P1	Malaysian citizen, born in Australia, living in Singapore, working remotely in Indonesia	Male	Algorithm development, AI
P2	South African citizen living in South Africa	Male	Space industry
P3	German citizen living in Germany	Female	Education
P4	Indian citizen living in India	Female	Psychology
P5	Australian citizen living in Australia	Female	Entrepreneur
P6	Indian citizen living in India	Female	Business management
P7	Indian citizen living in the United Arab Emirates (UAE)	Male	Business management
P8	Moroccan citizen living in the United States	Male	Digital sciences

AI, artificial intelligence; P, participant.

Quality criteria

For the study, quality criteria were established to evaluate the qualitative research, including ethics, clarity and coherence of the research and research report, the use of appropriate and rigorous methods, reflexivity, and attention to the researcher's bias (Cohen & Crabtree, 2008). Accordingly, the study follows the principle that qualitative research should be robust, thoroughly documented and well-informed (Nassaji, 2020). The classical qualitative quality criteria of credibility, transferability, dependability (Lincoln & Guba, 1985) and confirmability were applied, while ethical considerations were adhered to (Creswell, 2013).

According to Tracy (2010), the research criteria should include worthiness in terms of researching a worthy and practical topic, being rich in rigour, relevance, timeliness, significance, and morality. Besides demonstrating the quality criteria of a well-conducted research study, the study aimed to be sincere, credible, resonant, meaningful and coherent, and to make a significant contribution (Tracy, 2010). The researcher validated the findings through intersubjective validation processes, analysing and discussing the dataset and their interpretations with colleagues and other researchers (Yin, 2018). Finally, the researcher appreciated the selected criteria of Meyer and Dykes (2019) who point out that qualitative research needs to be informed, reflexive, plausible, and transparent. It therefore needs to inspire understanding of the subject matter and to invite action.

Limitations

The study comes with methodological and theoretical focus limitations. Findings are based on only eight in-depth interviews. They are all biased in the sense that only experts and leaders working in the field of the 4IR were interviewed. All of these leaders are working in the global economy, but were all trained and educated in Westernised educational and work settings. Therefore, this study might present very specific and biased insights. It is a qualitative study that focusses on a deeper understanding of the content and which does not claim statistical or analytical generalisations, but rather generalisation in terms of case-to-case transfer that, in qualitative research, is often referred to as transferability (Polit & Beck, 2010).

Ethical considerations

Ethical approved by Department of Industrial Psychology and People Management (IPPM) Research Ethic Committee. The clearance number is IPPM 2021-574. Ethical principles are an important aspect of qualitative research (Taquette & Borges da Matta Souza, 2022) and of the quality criteria mentioned above. Fundamental research ethics followed in this research are respect for persons, beneficence, justice, and respect for the community (Mack et al., 2005). The principles of informed consent and voluntary participation were applied, and participants were supplied with information about the research purpose, personal privacy, and anonymity (Patton, 2002).

Findings

In this section, the findings elaborated from the interviews are presented. The findings are presented in a way that reflects responses to the research questions through the voices of the leaders. Findings relate to leadership on the one hand and skill development on the other (see Figure 1).

Successful and effective leadership in the Fourth Industrial Revolution

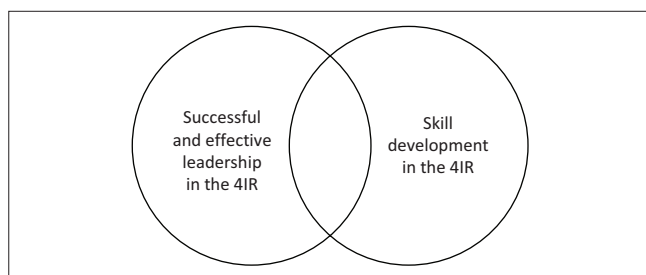
According to the leaders, successful and effective leadership in the 4IR integrates four crucial aspects, as shown in Figure 2.

Understanding and applying new technological trends

To lead successfully in the 4IR, the interviewed leaders believe that they need a complex understanding of the world, new trends, the economy, and their businesses. In particular, leaders highlighted that there should be a certain understanding of the new trends in technology and how they can be applied at work. During the interview, Participant 1 commented:

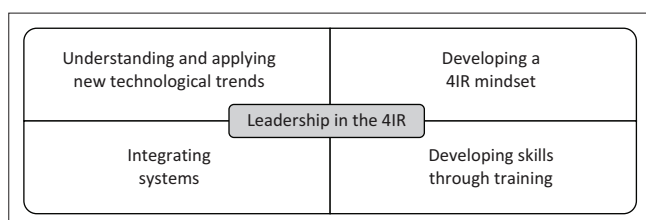
'[T]he future is an AI who'll be telling you what to do. Make your decisions and you do the thing, you become a slave. Or you can get a job now to learn how to program AI, to tell the AI what to do, and how to govern its own policies ... something that definitely I don't want to forget when I lead.' (Malaysian citizen, Male, Algorithm development, AI)

This interviewee pointed out that leaders have to be on top of technological advances so that they can lead and not be led by AI. To be leaders, and to make active decisions, the interviewees felt that individuals need to learn and continuously deal with technological applications, AI and others so that they can govern the advances and make the



4IR, Fourth Industrial Revolution.

FIGURE 1: Effective leadership and skill development.



4IR, Fourth Industrial Revolution.

FIGURE 2: Leadership aspects.

technology work for themselves instead of becoming slaves of technology.

Participant 7 highlighted that leadership and technology need to be integrative and interdisciplinary to be applied in the 4IR world:

'It's all collaboration; your thought was interdisciplinary because you have a lot of technology, you have a lot of analytics, you have a lot of business administration. All combined into one. So it's an interdisciplinary approach that is needed in the 4IR leadership ... if a budget, of course, plays a very important part in the technology adoption ... it all depends upon the leadership.' (Indian citizen living in the UAE, Male, Business management)

Participant 8 pointed to the complexity of the 4IR and emphasised that leaders need to be aware of the complexities of the new realities:

'[T]he way we define the fourth generation of industrialized services is the combination of industry grade automation that combines Internet of Things and cybersecurity because you need to protect it. It's a stack. And the stack starts from the infrastructure where you have those devices. And then you have the data layer; you aggregate all the data. And then you have the analytics that can take the data model to understand the patterns and behavior, and then sends a recommendation toward like a workflow or orchestrator that can execute certain things at a certain sequence. Okay, to do that you need some skills as I said, strength on software development. Okay. So anyone who doesn't, so you will find jobs disappearing, people who don't understand IT or software development.' (Moroccan citizen living in the US, Male, Digital sciences)

Participant 1 believed that if leaders do not have a complex and deeper understanding of the processes and applications, many of the work processes will disappear. He concluded accordingly:

'It's more application, just application, application, application, right? If the person doesn't know enough about the subject, how can they apply? Because AI has ... deep learning, which is neural networks, ... 3D neural networks, right? And then you've got machine learning, and you've got reinforcement learning. So these three are the main categories ... leaders should know.' (Malaysian citizen, Male, Algorithm development, AI)

Furthermore, Participant 1 emphasised that leaders need to know a great deal about the different systems and learning approaches to understand and apply the current trends in technology. This interviewee expressed the opinion that if leaders are not sufficiently knowledgeable, they might fail in the 4IR.

Participant 2 finally described his own analytical approach to the 4IR and how he manages gaps in the capabilities, technical resources, and tools to find a business model match:

'I looked at a technology we use, our software, our data sources and things like that. I looked at the training of my employees as well. Then I said, what can I do with a business model with these ... the human capabilities, the technical resources of the tools, and also what else? What tools am I missing? So I now, I actually

made it more practical ... so if I can find a business model match, that's real Industry Four and that's what I'll do.' (South African citizen living in South Africa, Male, Space industry)

Fourth Industrial Revolution mindset

Leaders in this study referred to the idea that they need a specific mindset when aiming to be successful in the 4IR, in that they needed to be curious, critical, entrepreneurial, problem-solving, and confident to deal successfully with the challenges and benefits of the 4IR. Participant 3, for example, highlighted:

'I'm curious about the future and I want to be part of It ... So what I think is really important for leaders and for all of us as citizens, is to keep a critical mindset, a critical attitude.' (German citizen living in Germany, Female, Education)

At the same time, Participant 8 supported Participant 3's notion of a critical mindset, creativity and governance:

'You need people who understand cognitively and who have a critical thinking, who have creativity, in order to study those different behaviors and develop ... It would be like critical thinking, an agile methodology ... so you need to have this kind of vision and skills that can leverage those smart people and do the governance, right?' (Moroccan citizen living in the US, Male, Digital sciences)

This interviewee believed that individuals with the described mindset need to lead and govern the development of the 4IR. Additionally, leaders emphasised how important the entrepreneurial mindset is. Participant 4 suggested the following:

'Get into entrepreneurship; there are wide opportunities ... you have to be resourceful in all terms in your people skills, life skills, leadership skills. Everybody can be a leader; you need to start leading yourself. Set an example and people will follow you. During the 4IR, the leader is required to be resourceful, to come up with creative business ideas.' (Indian citizen living in India, Female, Psychology)

Participant 8 narrated that leadership is about having a specific mindset of being a leader, being confident as follows:

'You need to also have a way, a leadership which has a confidence, but also down to earth, somebody who can work with his hands so people will follow. So, he leads by example. We don't see them previously, these are new people, the people who are doing that. Problem-solving is one of the most critical things. That's why I think that we're all in this course is to create that kind of thought process, about how you do problem-solving through design-thinking. It has to be a profound way to design the process as immersing yourself in that sense. So, this is where you need to talk to engineers on the level of software development level, the team leaders on another level, so you need to have that kind of skill set for leadership.' (Moroccan citizen living in the US, Male, Digital sciences)

Participant 8 brought these themes together, commenting that leadership is about connecting the different areas of the 4IR, being down to earth, confident, problem-solving and skill-orientated.

Training and skill development

Most of the leaders in this study agreed that leaders need to educate others, especially with regard to important technological skills. Participant 1, for example, confirmed:

'[Y]ou definitely have to educate on it. So, you need to educate employees on the opportunities. On the opportunities of AI, like, what AI can open doors for you on the opportunity side I would think.' (Malaysian citizen, Male, Algorithm development, AI)

Participant 2 pointed out that it is important to check the context in which people are operating while educating employees:

'In Germany, if you want to uplift a big part of manufacturing industry to the latest machine protocols so machines can talk to each other, will be a massive increase. In South Africa it's not yet, it's fairly small. So with government intervention you can actually have a sector uplifted to the next layer through education. ... in our business we have a spirit of continuous training, and I think that's also why I decided to do this course now and just lead by example.' (South African citizen living in South Africa, Male, Space industry)

According to Participant 3, training and development involves bridging differences and silos, which occur in organisations and increasing systemic and interdisciplinary interconnectedness:

'Let's say if we look at the future, we will have a lot, we will have much more remote workplaces. So as a leader you have to be able to hold that together. So, if you have different teams working in the virtual area, you have to be able to ... You need especially caretaking and loving, let's say, abilities.' (German citizen living in Germany, Female, Education)

Besides demonstrating caretaking and love, leaders also need the ability to educate and train others by using an acceptable approach, as shown in this statement. This approach might be storytelling. Participant 1 explained:

'Well, storyteller is always the most powerful way to communicate. So I would start with stories or some short form? ... if I were to consult with someone, it would naturally be to [pause] I don't like to say educate because if you say, I'm going to educate you, that's kind of insulting. I would probably start with storytelling, right or use case ... softer approach; storytelling, short storytelling. Based on opportunities for people. You got to hit them right in their heart, that's it. You got to find the opportunities for them. You got to serve the people if you want them to take it in.' (Malaysian citizen, Male, Algorithm development, AI)

In summary, the participant highlights that leaders need to be able to reach out to their employees, connect with them, and hold their attention using certain techniques, such as storytelling.

Societal and governmental influences

Finally, the interviews present the opinion that leaders need to interconnect their organisational aims with societal and governmental aims and influences. Participant 5 emphasised the importance of this interconnection:

'I feel like organized society can be quite progressive and organizations need to catch up. And I will be reflecting modern attitudes toward equality, whether it's women in the workplace or, you know, ethnic diversity, I feel like organizations need to be representative of the customer base or the communities that they supply. I think companies are putting themselves at risk when they go for the really pale, you know, male boards and things like that. I think that needs to change. So, I actually think it's more like society. Organizations need to carefully map where society's going with things and not pay too much attention to their own brand and their own image. They need to be looking at what's happening outside and around them.' (Australian citizen living in Australia, Female, Entrepreneur)

According to Participant 5, it is extremely important that organisations reflect the societies in which they act and that they explore what happens in their society to connect the aims of the organisation with broader social aims. Participant 7 added:

'What the greatest challenge for the country, for the everybody, is how to see the lowly skilled people who will come up. It's all about the people who are into education. I don't remember the percentage, but in every country, there's a good population, good percentage of the population, which is not even having a secondary education – if that is the case, then how do you develop that part of this society? Huge inequality, which will happen, it will actually get into the income inequality being developed much more and more. That could be chaotic for the society. Skilling and reskilling is a very important aspect in industry 4.0 from a planning perspective, from the smallest unit level to the highest level.' (Indian citizen living in the UAE, Male, Business management)

From Participant 7's perspective, organisations need to take care of those who do not have higher education, especially because the 4IR will create increasing inequality, which will be based on skilling and reskilling opportunities.

Findings from this study show that organisations and societies in the 4IR are strongly interconnected. Findings further reveal that organisations need to take societal changes into consideration, and 4IR processes are influenced by societal inequalities, which they usually strengthen. Organisations and societies were shown to be interlinked and their development is strongly integrated.

Skill development in the Fourth Industrial Revolution

Leaders in the research study referred to skill development by highlighting five important aspects: developing hard and soft skills, continuous training, values, attitudes, and anticipating future trends. The different categories of required skills are presented in Figure 3.

Soft skills and hard skills

Several interviewed leaders highlighted the importance of developing soft and hard skills to be prepared for the 4IR (P6, P7). Participant 6 pointed out:

'You want to break it down into hard skills and soft skills. Okay. So the soft skills are clearly, a beginner's mindset, an open mindset to embrace new technology and new ways of thinking; an open mindset to adopt a new lifestyle. ... in terms of hard skills, I think specialization ... hard skills in terms of technology, you have to specialize. I am not a leader in technology, but all I can say is that we have to be able to have empathetic innovators that are able to design products and services to match the new age.' (Indian citizen living in India, Female, Business management)

Other participants observed that empathy, design-thinking, critical problem-solving and interdisciplinarity were necessary aspects of the 4IR. Participant 7 stated that:

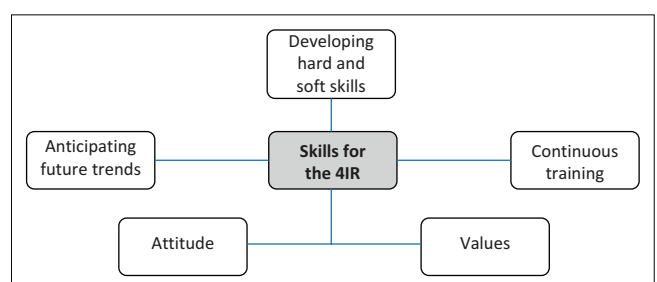
'I think in terms of the skills that you mention, empathy, of course. Then an offshoot of design-thinking and what design-thinking helps is critical problem-solving ... now the digital revolution industry 4.0 is all interdisciplinary.' (Indian citizen living in the UAE, Male, Business management)

While Participant 7 emphasised the importance of soft skills like empathy, critical problem-solving, design-thinking and collaborating, systemic approaches and interdisciplinary interconnections, Participant 1 highlighted the specific technological knowledge that is necessary to drive the 4IR, such as building trading algorithms and running an AI, and core coding. However, Participant 5 also mentioned that employees need to be multitasking on the surface rather than having an in-depth narrow mindset when they connect face-to-face to upskill, find themselves connected to others, and have a 'human connection for upskilling', 'mentoring' and 'coaching'. Participant 5 observed that the human element in soft and hard skills is crucial for further advancement.

Continuous training

All interviewed leaders pointed out that continuous training in the 4IR is vital. A few leaders point to the basics and to training on the job, for example Participant 2 commented that:

'[M]ath[ematics] and language is still important, you can't take that away. But instead of going into detailed training to be a, let's say, a B Tech in mechanical engineering, give more focus on the job training. And micro-credentials are far more relevant to a rapid environment where you must learn to learn first, whatever the technology field is. So that's the value of let's say a B Tech in engineering or in commerce, doesn't really matter. You just learn to learn.' (South African citizen living in South Africa, Male, Space industry)



4IR, Fourth Industrial Revolution.

FIGURE 3: Skills for the Fourth Industrial Revolution.

Participant 4 clarified that besides the knowledge and training, having a mentor or coach is very important: 'To have knowledge about it, get in some trainings. Have a mentor coach for yourself. So that what you don't know, they can help you to connect the dots'.

Participant 7 explained that organisations generally need to invest far more in trainings for their employees, while Participant 8 recommended that start-up workshops can support entrepreneurs and employees to learn, network with people in the industry, and create an innovative environment in which to learn and to bring private and government businesses together. These learning approaches also supported Participant 6's point of view that there is no systematic approach to learning and that curricula are not innovative enough:

'So it could be one particular thing in the curriculum. Even today, even today, I know in India, and elsewhere in Dubai, UAE, people talk about innovation, innovation, innovation. But really, there is no systematic approach or system or subject being taught about innovation.' (Indian citizen living in India, Female, Business management)

The interviewed leaders agreed that the 4IR learning content needs to be innovatively included in the curricula and people need to learn new and systemic approaches to being innovative.

Finally, these findings show that trainings should offer: (1) basic learnings, (2) on-the-job training, (3) learning how to train, (4) personalised mentoring and coaching, and (5) opportunities to network and be entrepreneurial.

Values and attitudes of leaders

On the one hand, according to Participant 4, 'people skills' are extremely important in combination with 'situational leadership' which addresses rapid shifts and developments, while leaders need to be 'humble, powerful, connected, and open'.

On the other hand, from Participant 3's point of view, an open mind is extremely important as well as a willingness to learn, and having:

'[E]mpathy, curiosity ... You need the ability to have to work in a team, to organize yourself well, to collaborate well with others. You need a lot of digital skills. You have to be innovative.' (German citizen living in Germany, Female, Education)

Additionally, Participant 3 mentioned appreciation of others, openness, flexibility and sharing as being important values among employees.

Psychologist Participant 4 supported the idea that people need a 'mindset shift' and 'reprogramming your paradigm'. Similarly, Participant 5 highlighted the need for a shift, and for people to become inclusive of diversity. This view was supported by Participant 6 who proposed an attitude, which embraces the new and being open-minded:

'The most important is the emotional attitude, to be embracing new things, new ways of thinking and new technology. Not as a developer only, but also as a user. So, I should be open-minded.' (Indian citizen living in India, Female, Business management)

Furthermore, Participant 2 mentioned that leaders need to focus on comprehension and understanding what is going on, while Participant 5 stated that leaders need to be self-aware and reflective. In addition to the 'down-to-earth side' of 4IR leadership, the leaders in this study felt that spiritual values and virtues are necessary. Participant 6 observed:

'We should not lose the spiritual attitude at all. Because we're all connected. We're all parts of that same quantum force that rules the universe ... I believe in humanity, in humanism, ... I believe that everything around us, even matter, even matter as objects have an energy to it. There has to be an attitude of love and tolerance toward everything around us.' (Indian citizen living in India, Female, Business management)

Participant 8 expressed a similar view, but considered 'ethics' and 'a culture of trust' to be particularly important, especially when working with big data, bias, and predictive analytics:

For P1, this goes together with an optimistic view:

'If you do the work for AI, to understand it and apply it properly, you should get stellar results, amazing results, you know, amazing efficiencies beyond what a human can do. You're just maximizing the opportunity, any opportunity that is applied. So, if you have that attitude, you're going to look forward to it. So that's my attitude.' (Malaysian citizen, Male, Algorithm development, AI)

In conclusion, the values and attitudes by the participant leaders in this study focussed predominantly on being open and positive, humble, flexible, and connecting and empathetic with others. Mainly, the individual values and attitudes are important, followed by the interpersonal values and attitudes, organisational, societal and spiritual layers. Table 3 provides an overview of these findings.

Anticipating future trends

The participants pointed out that leaders need to anticipate the future and future trends. Participant 2 noted that knowledge about certain industrial development is required, as well as insight into smart systems and their developments. Participant 4 referred to the fact that the future will only be manageable when people 'start helping each other or have an

TABLE 3: Values and attitudes.

Level	Values	Attitudes
Individual	Open, humble, powerful, connected, self-aware and reflective, curious	Love and tolerance, optimistic attitude, shifting the mindset, reprogramming one's paradigm
Interpersonal	People skills, flexibility, sharing, appreciation of others, empathetic	Emotional attitude of embracing new things, new thinking, new technologies
Organisational	Ethics, culture of trust	Diversity management
Societal	Humanistic values	Embrace diversity
Spiritual	Connection with the environment and all things in the world	Energy, interconnectedness, humanism

attitude that we all need to grow. Yes, we all need to support each other’.

However, Participant 3 suggested that the trends of the 4IR might differ around the world, observing that the 4IR cannot be defined by the Global North alone:

‘We need to ... [be] defining what the world makes; ... this will not work and that will not make any global change. And that will not save the planet and the future of human beings. That will not make social justice save the world. We know that already.’ (German citizen living in Germany, Female, Education)

According to Participant 3, the world needs a balance in future that is inclusive, bringing North and South together to save the planet, creating social justice and global changes, which will take the future of humankind into consideration.

Discussion

The study explored the perspective of global leaders on leadership and employee skills in the 4IR. All of the leaders interviewed agreed with the perspective offered in the literature that the 4IR will bring new technologies, radical changes and complex work situations (see Becker & Stern, 2016; Liao et al., 2017; Peters, 2017; Schwab, 2017). Findings show that leaders need to focus on understanding and applying new technological trends, working on a mindset that is constructive for the 4IR, and on skill development through training and integrated systems management which will help to integrate the organisation’s system into one complete framework so that it can work as a single unit.

The study participants did not define or consider the radical changes as disruptive (Kruger, 2020), but instead highlighted the need to be on top of the changes in order to drive them. Because they see themselves as knowledgeable, informed, and educated in addition to being trained to drive the 4IR, the participants were largely positive about the expected changes. This supports the previous findings of Mayer and Oosthuizen (2021) in a single-case company study in South Africa that the 4IR is an exciting development. Whereas the company managers in the Mayer and Oosthuizen (2021) study were insecure about the approaching changes, leaders in this study did not fear the 4IR. They demonstrated awareness that the 4IR brings both challenges and benefits; however, they did not seem to be unsettled by the challenges, as previously found in the study by Xu et al. (2018). The leaders in this study knew that they need to have a broad and applicable knowledge to deal with the 4IR in the best way. They, as well as their employees, understood that they need a positive mindset. This mindset needs to be not only curious, critical, entrepreneurial, problem-solving and confident, but also creative, reflective, skill-orientated, and innovative. As highlighted by Shapshak (2019), the participant leaders agreed that both leaders and employees required a systemic, eco-orientated, integrated mindset, which focusses on collective behaviour (see Kelly, 2019). This corroborates Gleason’s (2018) findings that flexibility and adaptability are needed to progress in the 4IR.

All of the participants pointed out that learning and skill development through training is vital, as found by Modise and van den Berg (2021). According to the current findings, training needs to foster soft and hard skills and should focus primarily on on-the-job training, which integrates aspects of all the different skills an employee needs to learn.

Leaders, according to Giardino (2019), need to be agile, emotionally and culturally intelligent, humble, confident, visionary, flexible, tech-orientated, intuitive, collaborative, quick to learn, authentic and focussed. The interviewees in this study agreed with all of these requirements, noting that flexibility and complexity seem to be similarly important. The interviewed leaders further agreed that creativity and entrepreneurial skills, as found by Almaloy (2023), are of major significance.

While the literature (Kelly, 2019) points to the significance of swarm organisations (collaborative and network-based), leaders in this study do not comment particularly on the influence of government on the organisation. Instead, they support the network ideal of organisations and governments working together as an integrated whole (as in previous literature, such as Abe et al. (2021); Ayinde & Kirkwood 2020; Chaka 2021). With this in mind, leaders in the study agreed with the literature (see Mduli & Makhupe, 2017; Ntombela & Civilcharran, 2023) that soft skills and hard skills are both key. However, they did not focus on sociocultural skills as does the literature (Mayer & Oosthuizen, 2020).

Although the literature (e.g., Renjen, 2019) is at times critical of 4IR leadership, leaders in this study were not critical of themselves or the 4IR processes. They scarcely mentioned risks or downfalls, although they acknowledged that they should be reflective and critical. The same is true of Aristotelian leadership (Tzavaras & Stelios, 2022): Only one female leader in that study commented that ethics and justice need to be taken into consideration in 4IR leadership to counteract inequality in the world.

Employee skill development is necessary for the 4IR. This requires employees to not only learn new skills, but to apply them (Caravella & Menghini 2018; Makridakis, 2017; Park, 2017). Because the leaders in this study were aware of the possibility that employees might fail to apply the skills learned, they therefore instituted on-the-job training and adjusted organisational strategies and processes accordingly.

Working in 4IR organisations needs a specific set of values and attitudes according to the participants of the study. In citing individual, interpersonal, organisational, societal and spiritual values and attitudes, participants partially supported the views of, for example Hecklau et al. (2016) on technical, methodological and social skills. However, leaders in this study did not emphasise sustainability or sustainable solutions, nor political and legal standards, nor did they

mention data security and privacy issues. Instead, they held a strong focus on openness, positive mindset and humanistic aspects of 4IR leadership (as in Ntombela & Civilcharran, 2023). Interestingly, leaders in this study focussed very little on the organisational level of the 4IR, while they mentioned spiritual values and spiritual interconnectedness, which are seldom mentioned in the literature.

Conclusions and recommendations

This study presented findings of global leaders and their views on the 4IR, specifically the leadership and skills needed to work effectively and successfully in the 4IR. It can be concluded that leaders are positive about 4IR developments; they see the necessity of always understanding and mastering the latest technological developments and then applying the new systems within their organisations.

A focus of the global leaders is definitely on developing values, attitudes and mindsets that are flexible and constructive and which follow humanistic values by taking all systemic levels into consideration: individual, interpersonal, organisational, societal as well as spiritual. Leaders take the present into account while continuously learning and developing, and anticipating future developments. Based on these findings, for the leaders of the 4IR, it is necessary to have an integrated, holistic mindset, which is open to further developments. Accordingly, soft skills seem to be the focus for leaders when skills for the 4IR are developed and grow on all systemic levels. Findings show further that the human aspect of leadership is considered as valuable as the technological aspect, and that leaders attend to mentoring, coaching and on-the-job training when it comes to skill development.

Future research needs to focus on the preferences of leaders regarding leaders' and employees' skill development and the sociocultural influences on these developmental aspects. In addition, studies need to explore what leaders think about future artificial and machine leadership, where they see challenges, advantages and disadvantages, and where and how humanity needs to come into play when robots and machines start managing organisations. Niches of human and machine leadership need to be explored and defined in future research and humanism in organisations needs to be redefined and critically applied.

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