Exploring the potential of design thinking in the age of fourth industrial revolution in South Africa

Itunu Ayodeji Bodunrin, *University of Johannesburg*

Abstract

Design thinking (DT) has recently re-emerged as an essential mindset and skillshift for modern organisations seeking to improve innovation performance in the fourth industrial revolution (4IR). However, despite recent popularity and success especially in the tech industry, DT has lacked critical academic engagement and scholarly enquiry especially in Africa. Hence, this paper sets out to provide empirical evidence on how DT can help create opportunities and innovation in an AI/Algorithm-driven 4IR era, and why the design curriculum in higher education should be updated to include DT competencies. This paper argues that in the era of 4IR (characterised by rapid automation and high demand for technological, social and emotional and higher cognitive skills), there is a greater need for DT and similar methods that positions immediate human/societal needs at the centre of critical technological innovations. This is even more crucial in the South African context where the longstanding socio-economic inequality is being exacerbated by COVID-19 pandemic, which will have long-term impacts on people's needs and wants, and fundamentally change the traditional ways of being. The paper concludes that DT presents an opportunity for design educators to adapt their core to meet the rapidly shifting societal needs and identify and quickly address new opportunity areas being created by the COVID-19 and the emerging technological landscape. The presentation reviews existing empirical studies, with the aim of helping design educators make sense of the emerging 4IR landscape, while providing them with evidence of how DT can be an essential tool to drive innovation-led growth that addresses human needs in the era of 4IR, and amidst the precarity of the global pandemic in contemporary South Africa.

Keywords: 4IR, design for educators, design thinking, ideation, innovation

Introduction: Design thinking as a method for humanizing 4IR technologies

Design Thinking (DT) is a human-centred, cognitive, and iterative ideation process for identifying and addressing stakeholder needs and solving wicked problems via a bottom-up design process. This contrasts the traditional top-down design processes that rely on "experts" within organisational boundaries and ivory towers to curate and design for the needs of others. In essence, DT opens up the design space for dialogue among all stakeholders (designers, end users, managers, among others) as a means to enhance the possibility for creative imagination and innovation (Johansson-Sköldberg, et al., 2013).

Initially pioneered by the private sector players, the DT approach has gained prominence is being used by some national governments as well as supranational organisations such as the European Commission, the United Nations Development Programme (UNDP), and the World Bank as a way to tackle complex human issues and deliver public service solutions (Elk, 2020). The shift towards tackling fundamental societal problems (wicked problems) through human[46] engagements or re-framing design problems in human-centric ways comes amidst the increasing permeation of data-churning smart machines and cognitive computing technologies such as machine learning, artificial intelligence, which promises to solve human problems through collection and analysis of volumes of computer-generated data.[47] DT expert, Liedtka (2018) argue that despite these arrays of technologies, only a deep immersion in the real world of human experience can produce high-quality data that can be transformed into insights, and which can help stakeholders agree on design criteria that can be used to proffer relevant solutions.

It is said that DT has in the last decade evolved to become one the main approaches to understanding, enhancing and augmenting the impact of contemporary technology of the fourth industrial revolution (4IR) (Pitsis, et al., 2020). The emergence of COVID-19 and subsequent government-enforced lockdowns around the world since the early 2020 further accelerated digital transformation, deepened the digitisation of marketised and domesticated social structures, leading to unprecedented levels of global online and digital use. According to a McKinsey report, the pandemic forced many organisations and businesses to change their go-to-market model since the pandemic hit. An overwhelming majority of 96% of businesses were said to have turned to multiple forms of digital engagement with customers. The report further positions "technology" as the biggest opportunity in the post-COVID-19 era (Figure 1). Indeed, studies have shown that companies that embrace digital transformation generally outperform their peers and are known to be more profitable (MIT, 2013).

One may therefore conclude that digitisation and 4IR technologies are rapidly impacting the traditional ways of being and doing business (Jordan, 2020). Hence, there is a dire need to critically reflect and rethink the place of humans (in relation to machines) in solving humanity's most wicked problems and other post-digital societal issues. Stanford design scholar and the founder of global design firm IDEO, Tim Brown, is credited to have defined DT as a human-centred approach to innovation that explores and integrate the needs of people and the possibilities of technology as requirements for business success. His definition reiterates that a key aspect of the DT is the designer's ability prioritise human needs ahead of technological solutions and business viability, through abductive reasoning known to produce new solutions for future situations.
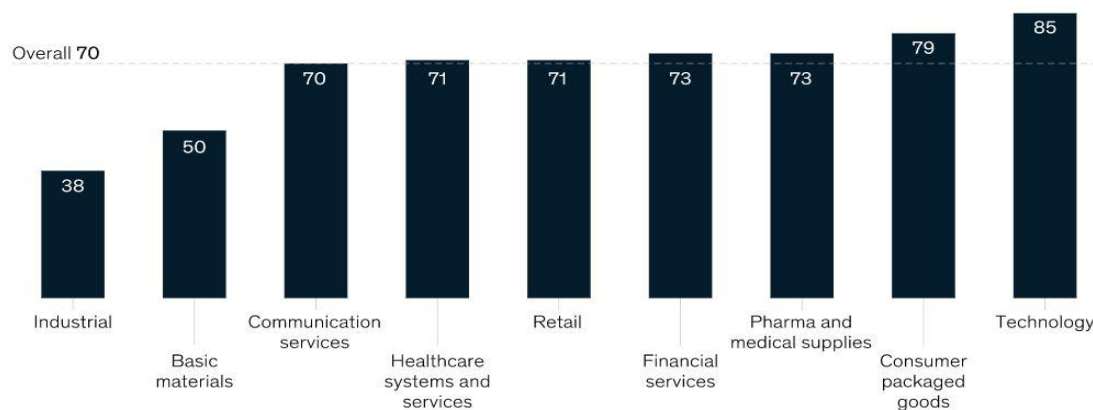
This contradicts the tenets of technology determinism theory and model of modernisation, where it is assumed that technology should primarily determine the development of society's social structures and cultural values (Hallström, 2020). DT and related methodologies assumes that the problem of humanity lies within the human realm, and one cannot rely exclusively on technology alone, which continues to contribute to the problem in the first place (Hallström, 2020).

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[80] By humans, I mean student, employee, consumers, among others.

[81] Here, I refer to the business intelligence (BI) and advanced analytics, whereby computers run algorithms to analyse data to identify patterns and then use those patterns to generate insights into past and current events and, later, offer insights on what would happen and what could happen if certain future actions were taken (http://www.interaction-design.org)

Share of executives who expect the COVID-19 crisis to be 1 of the biggest opportunities for growth in their industry, %

Overall **70**

Industrial	Basic materials	Communication services	Healthcare systems and services	Retail	Financial services	Pharma and medical supplies	Consumer packaged goods	Technology
38	50	70	71	71	73	73	79	85

Source: McKinsey Innovation through Crisis Survey, April 2020

McKinsey & Company

Figure 1: A graphic presentation of study published by McKinsey & Company which showed 'technology' as the biggest opportunity during and after the pandemic (AM, et al., 2020)

While the current fourth industrial revolution and its accompanying disruptive technologies have delivered many positive developments, for example, advances in health and sciences as well as boundless new opportunities to innovate and create new directions for businesses through optimisation of users' data to create personalised products and services, in an instant on-demand manner, there remain ethical concerns on how the vast amount of data generated are captured, manipulated and (mis)used by organisations and brands. This is already generating debates around what is known as data colonialism and surveillance capitalism (Allen, 2017). Others have cautioned against an ongoing prioritisation of these technologies over the immediate fundamental human and social needs (Hallström, 2020), and that these advancements tend to further alienate the poor and the digitally excluded in spaces such as Africa (where digital access remains a privilege of some), despite continued imagining of a post-digital world.[48] Additionally, a recent research conducted by Giaccardi and Redström (2020) suggests that the current era of 4IR intelligent of machine to machine interaction, machines are in fact the "stakeholders who design and curate realities for us" How then can one make sense of a setting where the so-called stakeholders are almost exclusively machines?

The current paper thus argues for the need to re-insert human at the centre of the technological innovation or humanise these 4IR systems to ensure that humans can influence technology (rather than vice versa), in order to be able to navigate the 4IR era with responsibility and responsiveness to deep human needs. Design-thinking embodies the skillset ideal in counteracting above mentioned issues associated with the 4IR including machine biases, flawed data sampling which causes over or underrepresentation in the training data and contestation of data use by organisations and other ethical concerns (Giaccardi & Redström, 2020). DT emphasises engagement, dialogue and involves end users and other

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[82] The post-digital era as an age of digital ubiquity with pervasive sense ennui, when our excitement of a novel technology will be replaced by the possible anxiety of knowing its future burden (Hallström, 2020).

stakeholders in the definition of the problem and the development of solutions, design thinking garners a broad commitment to change".[49]

Globally, DT has become a standard part of the curriculum in many business and design schools, and a primary means of innovation for many top companies worldwide, including Apple, SAP, Google, Siemens, Intel, IBM, Arup, and NASA, Coca-Cola, Versace, Samsung, IBM and Microsoft.[50] The growing interest and stronger strategic emphasis on DT is embodied in the emergence of specialised DT schools (such as the famous d.school Stanford University and d.school University of Capetown, South Africa). Although DT has existed for decades, it has only recently begun to gain wider popularity and currently being institutionalised in academia.

DT has been explored not just for product and strategic design, it has been used to explore new areas that shifts the frontiers of human understanding of their environments including the adaptability of people to new technologies. Hence, some scholars have noted that the use of DT should not be geared only at producing results or an end product, rather it should be positioned as the process which creates and uncovers patterns likely to lead to excellence. According to Brian Ling from Design Sojourn (2014):

> Design thinking has not produced the results that many organisations have been hoping for, because design thinkers that have not been classically trained in design "doing" will likely not realiz\se that great innovative solutions do not come at the end of the process; they come from any part of the process. Design is an iterative activity that only has broad guidelines but no fixed process. What's more important is that critical insights, sensitivity to consumer needs and beautiful solutions come from the creative chaos encouraged by an open design process.

Studies have shown that organisations that make DT a central strategic focus are more likely to develop a sustainable advantage for the future.[51] DT presents new ways of tackling problems via a radical shift away from the traditional convergent thinking (of making best choices out of available alternatives) to divergent thinking (creating choices by exploring new alternative and ideas that were not available before).

The DT process is made up of several practical participatory and collaborative methods that are used to iteratively empathise, define, ideate, prototype, and test. Essentially, DT may be regarded as creative and analytic creative process that engages all stakeholder is the design process which includes experimenting, (re)create, rapid prototyping models, gathering of feedback, and possible redesigning (Pitsis, et al., 2020). While there are numerous versions of DT, they all seem to point to the fact that DT is neither simple nor linear. A model proposed by the Hasso-Plattner Institute of Design at Stanford (also known as d.school) seems to present the most basic tenets of Design thinking. This five-stage is presented below:

Empathising: Understanding the human needs involved.

Defining: Re-framing and defining the problem in human-centric ways.

[83] https://hbr.org/2018/09/why-design-thinking-works

[50] https://cmr.berkeley.edu/2020/02/62-2-pitsis/, https://futurelondonacademy.co.uk/en/course/design-thinking-and-innovation?utm_source=zoe-comments

[51] https://journals.sagepub.com/doi/10.1177/0008125620907163

Ideating: Creating many ideas in ideation sessions.

Prototyping: Adopting a hands-on approach in prototyping.

Testing: Developing a prototype/solution to the problem.

It is important to note that the DT process is neither non-linear nor a sequential step-by-step process as depicted in the diagram. Hence, some have criticised the way DT has been presented like a linearly step-by-step gated process, when in practice, the process ought to be carried out in a non-linear and more flexible fashion (Pitsis, et al., 2020). For example, different groups or individuals in a design team can concurrently conduct more than one stage. In other words, it is possible for designers to collect information prototype during an entire project in a bid to visualise solutions and bring ideas to life. The results from the testing phase can reveal insights, which in turn may lead back to the process of ideation. Alternatively, the need for the development of new prototypes. Creativity is bound to be stifled if design thinkers are required to make DT to have rigid structures and repeatability (Ling, 2014). Figure 2 depicts the non-linearity of the DT process:
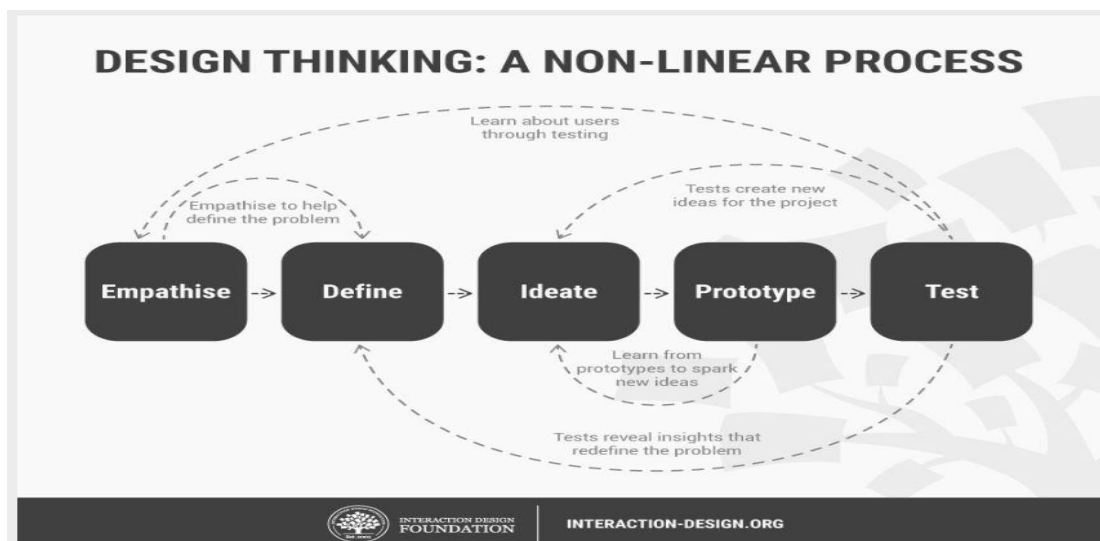

Figure 2: A diagram showing the flexibility and non-linear nature of the DT process
https://www.interaction-design.org/literature/topics/design-thinking

It is important to note that there have been varying definitions, methods, and models that have been described as DT in the last few decades. The one discussed and depicted in Figure 2 seems to be the basic that can be amended to fit the design needs in various fields such as product design, psychology, and anthropology. While many are aware of the various tools and methods of DT, Braun, et al. (2014) notes that the mastery needed to use these methods and theories remained a major problem. They therefore advocate for a designer to lead the DT process by navigating, leveraging, and managing opportunities from the creative challenge.

While DT training is offered across various disciplines and modified to meet varying disciplinary demands, several authors have suggested that the core of DT with its complexities and nuances ought to be situated in the academic field of design. They argue that a design mastery is needed to excel in the DT process, and that design schools should remain the main custodians of the core knowledge on DT, as a trained designer is more likely to offer a clearly unique thinking approach to the complex practice of DT (Johansson-Sköldberg, et al., 2013; Braun, 2014). They conclude that disciplines and business schools who claim to offer DT outside the design discipline are merely practising "designerly thinking" – the borrowing and

adaptation of design toolkits, methods, and innate competencies of a designer (Johansson-Sköldberg, et al., 2013; Braun, 2014).

In similar vein, this current presentation advocates for a discipline-based mastery of DT as an essential tool for negotiating the complex fourth industrial revolution (4IR) and the African social realities. As earlier alluded, the 4IR is currently confronted with new problems and new issues related to ethics, accountability, responsiveness and other undiscovered issues that will require heuristic techniques to solve. I therefore propose that DT can become the ideal heuristic technique to deal with these issues that may emanate as a result of the increasing dependency on smart machines, artificial intelligence and other elements of 4IR especially within the contest of South Africa and Africa. Despite South Africa's recent funding and positioning as a leader in 4IR in the continent, there remains a need to use these technologies to solve longstanding issues related to socio-economic disparity, race relation, corruption and other issues that continue to blight the country.

Criticism of design thinking and why designers must take the lead

Like any design strategy, DT has been subjected to numerous criticisms. For example, Natasha Iskander (2018) notes that the claims that DT encourages innovation is untrue, instead, she argues that DT uses strategies that seek to limit participation, preserve and defend the status-quo, thus privileging designers above the people they claim to serve. Other critics have noted that DT as a method is defined poorly, and that "it is little more than basic common sense, repackaged and then marketed for a hefty consulting fee" (Vinsel, 2018). In fact, Iskander (2018) further argues that DT is simply a "dumbed down" — version of the methods that designers use, which has now been enthusiastically embraced by managers and policy makers, government and various disciplines in higher institutions. However, irrespective of the view core designers, DT has re-emerged and is increasingly embraced as one of the most sort after interdisciplinary approach for social innovation in South Africa and across the globe. In the fourth industrial revolution, there has been a great deal of emphasis on interdisciplinary or need for multi-disciplinary teams to come together to solve real-world problems (WEF, 2018). DT seem to be taken the lead in this regard. However, for it to thrive in South Africa, the Design curriculum must be reworked to emphasise DT or at least there has to be a level of commitment from design schools in South Africa and Africa towards providing the conditions for DT to flourish.

The state of design thinking and 4IR in contemporary South Africa

The COVID-19 pandemic struck at a time when South Africa government and the private sector had begun a concerted partnership towards digitising and re-positioning its economy towards the fourth industrial revolution. On 9 April 2019, the South African President, Cyril Ramaphosa established a 30-member Presidential Commission on 4IR to develop an integrated national response strategy and determine areas of development in the short, medium and long-term within the 4IR.[52] This was followed by an inaugural fourth industrial revolution (4IR) Digital Economy Summit of July 2019 where the president declared that "South Africa had chosen to be a country of the future at a time when the world was changing at a pace and in a manner

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[52] http://www.thepresidency.gov.za/press-statements/president-appoints-commission-fourth-industrial-revolution.

that was unprecedented in human history". In an address on January 10 2020, the president also reiterated that:

> [T]he fourth industrial revolution (4IR) represents the great tectonic shift of our time. It is creating new possibilities for improving people's lives. Disruptive technologies like machine learning, artificial intelligence, and big data are changing the way we live, the way we work and do business, and the way we govern.[53]

This speech highlights the radical shift towards the 4IR by the SA government like most governments and industries around the world. The government swung into action when it launched the "4IR Skills Programme", a programme aimed to upskill and build capacity for the SA's economy of the future. As part of the programme, the South African Department of Communications and Digital Technologies and Partnership through the Media, Information and Communication Technologies Sector Education and Training Authority (MICT SETA) partnered with private technology companies Microsoft to train over 1000 learners, skills that are key in fourth industrial revolution. This includes, data science, 3D printing, cloud computing, drone piloting, software development, cyber security, digital content production.[54]

Interestingly the MICT-SETA recently updated under its 4IR qualifications menu that it intends to develop and register qualifications that align with the fourth industrial revolution.[55] It listed the following

- Artificial intelligence
- Cyber security
- Cloud computing
- Data science
- Software development
- Internet of things
- Robotic processing automation
- Design thinking
- Quality engineering automation
- eWaste.

From above list, one can observe that DT is recognised as a crucial component of the fourth industrial revolution (4IR) and an important skill in a digital economy. This means that businesses can adopt DT for socio-technological and product innovations while actively participating in the South Africa government's National Development Plan. More importantly, there is a need for design educators in South Africa to begin to develop a more unified locally-relevant DT frameworks to train students to be active participants in the digital economy and the fourth industrial revolution.

A number of South African educational institutions (mostly private) have emerged in the last few years awarding DT degrees and trainings across the country. A few of them are listed below:

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[53] https://www.brookings.edu/blog/africa-in-focus/2020/01/10/a-national-strategy-for-harnessing-the-fourth-industrial-revolution-the-case-of-south-africa/

[54] https://www.mict.org.za/4ir-skills-programme/

[55] https://www.mict.org.za/the-fourth-industrial-revolution/

- Hasso Plattner Institute of Design Thinking at the University of Cape Town (d.School);
- The Design Thinkers Academy South Africa (https://www.designthinkersgroup.co.za/);
- The Design Center (https://designcenter.co.za/tcp-2_30_508-higher-certificate-in-design-thinking-nqf5.html). This private institution awards an NQF 5 Higher Certificate in Design Thinking;
- The Design Thinkers Group (https://www.designthinkersgroup.co.za/designthinkers-academy-1);
- Design for Change (DFC) South Africa Design for Change (http://www.dfcworld.com/SITE); and
- Craft & Design Institute (CDI) (https://www.thecdi.org.za/).

While DT training is offered across various disciplines and modified to meet varying disciplinary demands and business needs, several authors have suggested that the core of DT with its complexities and nuances ought to be situated in the academic field of Design. They argue that a design mastery is needed to excel in the DT process, and that design schools should remain the main custodians of the core knowledge on DT, as a trained designer is more likely to offer a clearly unique thinking approach to the complex practice of DT (Johansson-Sköldberg, et al., 2013; Braun, 2014). They conclude that disciplines and business schools who claim to offer DT outside the design discipline are merely practising "designerly thinking" – the borrowing and adaptation of design toolkits, methods, and innate competencies of a designer (Ibid).

DT is also relevant and in tandem with the broader calls for decolonisation of knowledge and the South African higher institutions of learning. The design field can be at the forefront of decolonisation when it refocuses its mandate from seeing design in terms of functionality or aesthetics to positioning itself and providing students with methods such as DT as a powerful ontological tool capable of transforming the social and cultural reality, and modelling human experience, subjectivity, and lifestyle. This is because as Tlostanova (2017, p. 1) notes "design is clearly one of the few spheres in which ontology, epistemology, and axiology intersect in a dynamic and creative way". Globally, decolonisation in the field and practice of design has largely emphasised the need for people-centred co-design processes that allow anyone and everyone participate in design process irrespective of their expertise or socio-economic, gender and racial identities or positions in the society. DT embodies this principle. DT when adapted in the global South context has the capacity to allow people critically reflect and contest frames of normalised modernity/coloniality. Studies such as Rashied and Bhamjee (2020) have shown that for the Global South to reap the benefits of the fourth industrial revolution and avoid renewed (economic) coloniality in the hands of the more developed Global North, it needs to decolonise the 4IR technology.

Hence, in this precarious era of 4IR, DT can be a critical facilitator around coloniality and other complexity associated with accompanying new technologies. DT has thus been regarded as a technology in its own right—a social technology that encourages more productive innovation conversations that are strategically valuable for dynamic capability building. DT can accelerate progress on critical imperatives: allowing innovators at all levels to sense new opportunities; seize them by overcoming cognitive biases and aligning stakeholders; and transform and reconfigure resources. It accomplishes this through a set of well-recognised practices (Pitsis, et al., 2020). It emphasises human-centred principles that focus on an empathetic understanding of people and their specific needs. In an era of rapid social, environmental, and technological change, orienting the innovation process around human-centred design principles can provide a much-needed focal point. DT and similar approaches remain stubbornly analogue in seeking solutions that place human needs at the forefront. It asks questions of how with technology we can examine the emotional engagement of the clients and most importantly to the question of customer self-esteem. When Businesses adopt a DT

as a user-centred approach, their evolution happens in ways that are both tangible and experiential. Products will be tailored and formulated to exact specifications based on lifestyle, usage, and even genetics of the end users.

According to DT expert at IDEO, Tom Kelley, Design Thinking Brief in 4IR poses the following question:

- What if everyone in the organization help innovate?
- How do we get better at divergent thinking?
- How do we balance the needs of people, technology, and business?
- How do we expand innovation beyond technology?
- How might we manage innovation portfolio?
- How might we (re)create essential services that we use?
- How might our customers help us innovate?
- How might we redesign large-scale systems?
- How do we make products that have minimal environmental impact?
- Where might the next destructive innovation come from?
- How does design help people move out of poverty?
- How might we make health care cost less?
- How do we educate future innovators?
- How do we impact through innovation?
- How do I make myself more creative?
- How do I have more impact through innovation?

The COVID-19 pandemic disruption of familial face-to-face interactions means that the entire process of the DT may be coordinated via electronic means of communication. Platforms such as Zoom, Microsoft Teams, and Slack can be used to facilitate the various stages of the DT process while connecting to various stakeholders (between employees, management, customers, investors, among others). Empirical studies have shown that prioritizing innovation during crisis (such as pandemic) is the key to unlocking post-crisis growth (Am, et al., 2020). As we await normalcy or are compelled to accept the idea of a "new normal', it is important for organisation and businesses to commit to innovation and innovative solutions using DT methods. This will allow them connect deeply with the customers and stay ahead of the curve. DT has proven to lead to sustainable benefits for all stakeholders (internal and external).

Conclusion: A call for a unified South African design-thinking curriculum

The DT approach has been used effectively in the private sector to innovate and create solutions for competitive advantage. In today's globally competitive world, design schools themselves ought to be at the forefront of DT education and research and this should be encouraged in South African design education system. In addition to being a vital resource in the fourth industrial revolution, DT also immerses students and teachers (i.e. the designers) in real-world problem solving, allowing them to contribute meaningfully to the society. It encourages interdisciplinary in its aim to solve humanity's daunting problems

While DT training is offered across various disciplines and modified to meet varying disciplinary demands and business needs, there are calls for real designers and the design schools to take the lead as custodians of the core knowledge on DT. This is against the backdrop of the perception that a trained designer is more likely to offer a clearly unique thinking approach to the complex practice of DT. There is therefore a need to incorporate DT into design curriculum

to produce trained DT facilitators who may be able to work outside the design space to help innovate and solve some of the daunting challenges in the era fourth industrial revolution.

This current presentation advocates for a discipline-based mastery of DT as an essential tool for negotiating the complex fourth industrial revolution (4IR) and the African social realities. As earlier alluded, the 4IR is currently confronted with new problems and new issues related to ethics, accountability, responsiveness and other undiscovered issues that will require heuristic techniques to solve. South Africa's concerted effort towards positioning its economy for the 4IR presents an opportunity for design educators to design a locally relevant DT methodology and framework to address the many complex problems that accompany the technology and add value to peoples' lives. As discussed throughout this paper, empirical studies have shown that indeed, DT makes the difference in terms of enhancing or augmenting the impact of technology. DT has the potential to identify longstanding societal problems (in areas such as healthcare, education, urbanisation, housing, among others), as well as new opportunity areas being created by the changing technological landscape. Despite numerous criticisms from designers and other academy-based scholars, DT has evolved into a 4IR essential skills. Hence, Design educators ought to begin to reflect on how best to integrate DT into the design curriculum.

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