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**Ismail Sheik**

NAVIGATING THE DIGITAL DIVIDE: EXPLORING THE MULTIFACETED 4IR CHALLENGES AND TECHNOLOGICAL DISPARITIES ENCOUNTERED BY SMMEs WITHIN KWAZULU-NATAL, SOUTH AFRICA

The dawn of the Fourth Industrial Revolution (4IR) has been a harbinger of unparalleled technological innovations, reshaping industries and economies at an unprecedented pace. While these advancements promise a new frontier of opportunities, they also bring forth a myriad of challenges, particularly for Small, Micro, and Medium-Sized Enterprises (SMMEs). This research delves deep into the multifaceted challenges and technological disparities encountered by SMMEs in the wake of 4IR, with a concentrated lens on the enterprises operating within the KwaZulu-Natal region of South Africa.

At the heart of this exploration is the pronounced digital divide, which exacerbates the gulf between well-resourced corporations and SMMEs. The divide is not just technological but extends to areas like access to finance, digital literacy, infrastructure, and the agility to adapt to rapidly changing business environments. As these SMMEs grapple with the challenges of integrating into the digital economy, they face hurdles such as limited access to advanced technological tools, cybersecurity threats, the high cost of digital transformation, and a dearth of skilled manpower to navigate the complexities of 4IR.

Furthermore, the research sheds light on the systemic and infrastructural challenges in the KwaZulu-Natal region, which further compound the difficulties faced by local SMMEs. From inconsistent internet access and electricity issues to the lack of tailored training programs and financial schemes, these enterprises find themselves in a precarious position, trying to bridge the chasm between traditional business models and the demands of the digital age.

By offering an in-depth analysis of these challenges, this study seeks to provide a comprehensive understanding of the obstacles that SMMEs face in the current 4IR-driven economic climate. It emphasizes the need for a multi-stakeholder approach, involving governments, industry leaders, educational institutions, and financial institutions, to collaboratively develop strategies, policies, and interventions that can empower SMMEs. Through targeted support, capacity-building initiatives, and fostering an ecosystem of innovation, there's potential to not only narrow the digital divide but to position these enterprises as key players in South Africa's 4IR journey. This research, thus, serves as both a clarion call and a foundational blueprint for ensuring that no enterprise, regardless of its size, is left behind in this transformative era.

Keywords: *Fourth Industrial Revolution, SMMEs, disparities, technological challenges, digital divide, business adaptation.*

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1. Introduction

The Fourth Industrial Revolution characterized by technologies such as artificial intelligence, the Internet of Things (IoT), blockchain, and big data, is revolutionizing the way businesses operate globally [1]. While numerous sectors are reaping the benefits of this paradigm shift, the disparities between large enterprises and SMMEs are becoming increasingly evident [2].

SMMEs, which are vital for economic growth, employment generation, and innovation, face distinctive challenges

in the age of 4IR. These challenges often stem from limited access to financial resources, lack of technical expertise, and the rapid pace at which technology is evolving [3]. With the global economy becoming more interconnected and digitized, it's essential to comprehend the difficulties SMMEs face to ensure their sustainable growth and contribution to the broader economic fabric [4].

In South Africa's KwaZulu-Natal, a region with a rich tapestry of SMMEs spanning various sectors, the impact of 4IR is palpable [5]. While some enterprises have managed to adapt and thrive, others find themselves at the risk of being

left behind. The region provides a compelling backdrop against which the challenges and disparities can be assessed [6].

This research delves deep into the intricacies of the challenges faced by SMMEs in KwaZulu-Natal due to 4IR. Through a comprehensive exploration, the study seeks to offer insights that can guide policymakers, business leaders, and stakeholders in devising strategies that foster an inclusive, technologically adept, and robust SMME sector.

In the vast spectrum of business evolution during the 4IR, SMMEs in KwaZulu-Natal, South Africa, serve as the focal point of this research. Their unique positioning in the economy, coupled with the diverse challenges they face, makes them a significant object of study.

A comprehensive technological audit was conducted to assess the current technological landscape of SMMEs in the region. This audit revolved around several key parameters:

Adoption Rate: The extent to which SMMEs have integrated 4IR technologies such as IoT, AI, blockchain, and machine learning into their operations [7].

Infrastructure: Evaluating the current technological infrastructure, including digital platforms, hardware, software, and connectivity options available to these enterprises [8].

Skillset: Analyzing the technological proficiency of the workforce within SMMEs. This included understanding the gaps in skill sets and the readiness of the workforce to adapt to new technologies [9].

Financial Allocation: Investigating the proportion of resources SMMEs allocate towards technological advancement, innovation, and digital transformation [10].

External Support: Identifying the kind of technological support, if any, SMMEs receive from governmental bodies, NGOs, or private sectors [11].

The technological audit provided a holistic understanding of where SMMEs stand concerning 4IR and highlighted the disparities between their current state and where they ideally should be to leverage the full potential of the revolution.

In the rapidly evolving milieu of the 4IR, SMMEs have faced a plethora of challenges. Recognizing the crucial role SMMEs play in economies worldwide, various solutions have been proposed and implemented to address their unique issues in the 4IR era [12]. This section delves into the existing solutions, evaluating their effectiveness and applicability, especially in the context of KwaZulu-Natal's SMME landscape.

Digital Literacy and Training Programs: One of the foundational challenges SMMEs face is the lack of technological expertise [13]. Recognizing this, several institutions have rolled out digital literacy programs. For instance, the World Economic Forum's «Digital Transformation Initiative» [14] emphasizes the importance of equipping the workforce with digital skills. In South Africa, initiatives like the «Skills4Girls» project aim to close the digital gender divide, particularly in the tech industry [15].

Access to Capital and Financial Support: Financial constraints often hinder SMMEs from integrating advanced 4IR technologies. Recognizing this, the South African government launched the Small Enterprise Finance Agency (SEFA) to provide accessible financial assistance to small enterprises [16]. Globally, the World Bank's International Finance Corporation (IFC) also offers financial products tailored for SMMEs [17].

Technological Infrastructure Development: For successful integration into the 4IR framework, robust technological infrastructure is paramount. Countries like Singapore have excelled in creating a conducive environment for SMMEs

through the «Smart Nation» initiative, emphasizing infrastructure readiness [18]. Similarly, the South African government's investment in broadband infrastructure seeks to ensure that businesses, including SMMEs, can tap into the opportunities presented by 4IR [19].

Tailored Government Policies and Regulations: SMMEs require a supportive legislative environment to thrive. The South African National Development Plan 2030 underscores the importance of SMMEs and proposes various measures to create a favourable ecosystem for them [20]. Elsewhere, the European Commission's «Small Business Act for Europe» seeks to improve the approach to entrepreneurship, simplifying the regulatory and policy environment for SMMEs [21].

Networking and Collaboration Platforms: Collaborative platforms can help SMMEs share resources, knowledge, and best practices. The African Union's «Digital Transformation Strategy for Africa (2020–2030)» emphasizes collaborative efforts, fostering an environment where businesses can leverage shared digital resources [22]. Similarly, platforms like the Global Linkages Program by IFC aim to connect SMMEs with larger enterprises, facilitating knowledge and resource sharing [23].

Incubators and Accelerators: Start-up incubators and accelerators have gained prominence as effective mechanisms to support budding entrepreneurs. In KwaZulu-Natal, platforms like the Durban Innovation Hub provide not just infrastructural support but also mentorship, training, and networking opportunities [24]. Globally, renowned programs like Y Combinator have showcased the potential of such initiatives in shepherding start-ups through their initial phases [25].

Online Marketplaces and Digital Platforms: The rise of e-commerce platforms like Alibaba, Amazon, and Takealot provides SMMEs with expansive market access. These platforms reduce the need for physical infrastructure, allowing SMMEs to reach a global audience. Furthermore, platforms like Shopify offer tools tailored for SMMEs, allowing them to set up online stores with ease [26].

While numerous solutions exist to address the challenges faced by SMMEs in the 4IR era, the key lies in contextual application [27]. What works in one region or for one sector might not necessarily be effective elsewhere. For regions like KwaZulu-Natal, with its unique socio-economic landscape, solutions need to be tailored, keeping in mind local challenges and opportunities. Continuous research, stakeholder engagement, and iterative policy-making will be essential to ensure that SMMEs not only survive but thrive in the age of 4IR [28].

The aim of this research is to shed light on the challenges and disparities faced by SMMEs in KwaZulu-Natal within the 4IR context. By understanding these barriers, the study seeks to offer actionable insights that can assist in formulating strategies to foster the growth and resilience of these enterprises in an increasingly digital age.

The study's tasks are as follows:

- *Dissect the Challenges:* To comprehensively understand the multifaceted challenges faced by SMMEs, from technological barriers to financial constraints, and how these challenges are augmented in the 4IR landscape.
- *Analyse the Disparities:* To evaluate the gap between SMMEs and larger enterprises in terms of technology adoption, resource allocation, and overall readiness for 4IR.
- *Assess External Support Structures:* Understand the role of governmental and private entities in supporting SMMEs. This would involve studying existing policies, incentives, and programs aimed at SMME development in the context of 4IR.

– *Skillset and Training Evaluation*: To gauge the current skillset of employees within SMMEs and assess the training and development programs available to them to bridge the technological knowledge gap.

– *Formulate Recommendations*: Based on the findings, propose actionable strategies that can be employed by policymakers, business leaders, and other stakeholders to support the growth and competitiveness of SMMEs in the 4IR era.

Through these tasks, the research seeks to provide a comprehensive understanding of the current landscape and chart a path forward to ensure that SMMEs are not left behind in the digital revolution.

2. Materials and Methods

The methodological approach adopted in this research was specifically chosen to delve deep into the lived experiences and perceptions of SMME owners and managers [29] in KwaZulu-Natal as they navigate the challenges posed by the 4IR. A detailed description of the methods employed, from sampling to data analysis, is provided below.

2.1. Research design and approach. This study employed a qualitative research approach. Qualitative research is particularly suited for exploring and understanding complex phenomena, allowing for a deeper understanding of participants' experiences, interpretations, and meanings they ascribe to events [30]. Specifically, a phenomenological design was adopted, which aims to explore the essence of lived experiences about a phenomenon [31]. This design was deemed appropriate, given the exploratory nature of the study and the intent to understand the challenges faced by SMMEs in the context of 4IR.

2.2. Sampling and participants. A purposive sampling technique was utilized to select participants who have had first-hand experience in managing or owning SMMEs in KwaZulu-Natal amidst the 4IR challenges. This non-probability sampling method ensures that participants are chosen based on specific characteristics or qualities, ensuring relevance to the research question [32].

A total of 12 SMME managers and owners participated in the study, providing diverse insights from various sectors and industries.

2.3. Data collection. Semi-structured interviews were the primary data collection tool. This type of interview allows for a more flexible and organic conversation, permitting participants to express their views while ensuring that core topics are covered [33]. An interview guide, with open-ended questions, was developed and used to ensure consistency across interviews while allowing for spontaneous probing where necessary.

All interviews were conducted face-to-face, lasting between 45 minutes to an hour, and were audio-recorded with participants' consent.

2.4. Data analysis. Following the data collection, the audio recordings were transcribed verbatim. The transcriptions were then imported into NVivo, a qualitative data analysis software, to facilitate a more organized and systematic analysis [30].

A thematic analysis approach was employed, as described by [31]. This involved; Familiarization with the data by reading and re-reading the transcripts, generating initial codes from the data, searching for themes among

the codes, reviewing and refining the identified themes and defining and naming the themes [29].

2.5. Trustworthiness. To ensure the trustworthiness of the research findings, several measures were taken. Triangulation of data sources was achieved by collecting data from multiple participants across different sectors. Member checking was conducted, where participants were given a summary of the findings to verify the accuracy of the researcher's interpretations [32]. Lastly, an audit trail was maintained, documenting all research processes and decisions, enhancing the transparency and replicability of the study [33].

The methodological approach adopted in this study ensured a comprehensive exploration of the challenges faced by SMMEs in KwaZulu-Natal amidst the 4IR. By utilizing a phenomenological design, the research captured the depth and richness of participants' experiences, providing invaluable insights into the research problem.

3. Results and Discussion

The investigation into the challenges faced by SMMEs in KwaZulu-Natal amidst the 4IR has culminated in the emergence of distinct themes. These themes were derived from a comprehensive analysis of participant responses. In this section, let's delve into these themes and present the participant insights that have shaped our understanding.

The bubble diagram, as illustrated in Fig. 1, encompasses the primary themes emanating from our research. Each «bubble» symbolizes a distinct theme or sub-theme, and the size of each bubble is indicative of its frequency or prominence in participant responses [29]. In other words, larger bubbles represent themes that were more frequently highlighted or emphasized by participants, signaling their significance in the broader narrative of challenges faced by SMMEs in the 4IR landscape.

Moreover, the spatial arrangement of these bubbles is not arbitrary. Bubbles situated closer to one another suggest a conceptual or experiential link between those themes, highlighting areas where challenges might be inter-related or where one challenge exacerbates another [32].

3.1. Theme 1: Understanding 4IR in business operations and current workplace trends. The 4IR is marked by the convergence of digital, biological, and physical innovations [34]. The majority of our participants demonstrated an understanding of this convergence, highlighting its impact on business operations.

3.1.1. Integration and advancement. Most participants acknowledged the crucial role of integrating advanced technologies into their business operations. As Participant 1 elucidated, «*The Fourth Industrial Revolution represents the merging of the analogue, digital, and biological spheres, with technologies such as AI, IoT, and Quantum Computing taking centre stage*». This sentiment was echoed by Participant 3, who stated, «*The 4IR is marked by the integration of myriad emerging technologies in the business sector*».

3.1.2. Machine dominance. The rise of automation and machine learning means that machines are becoming integral to businesses [6, 35]. Participant 4 highlighted, «*From the termination of lockdowns, businesses are under more pressure than ever to adopt and adapt to these technological shifts*».

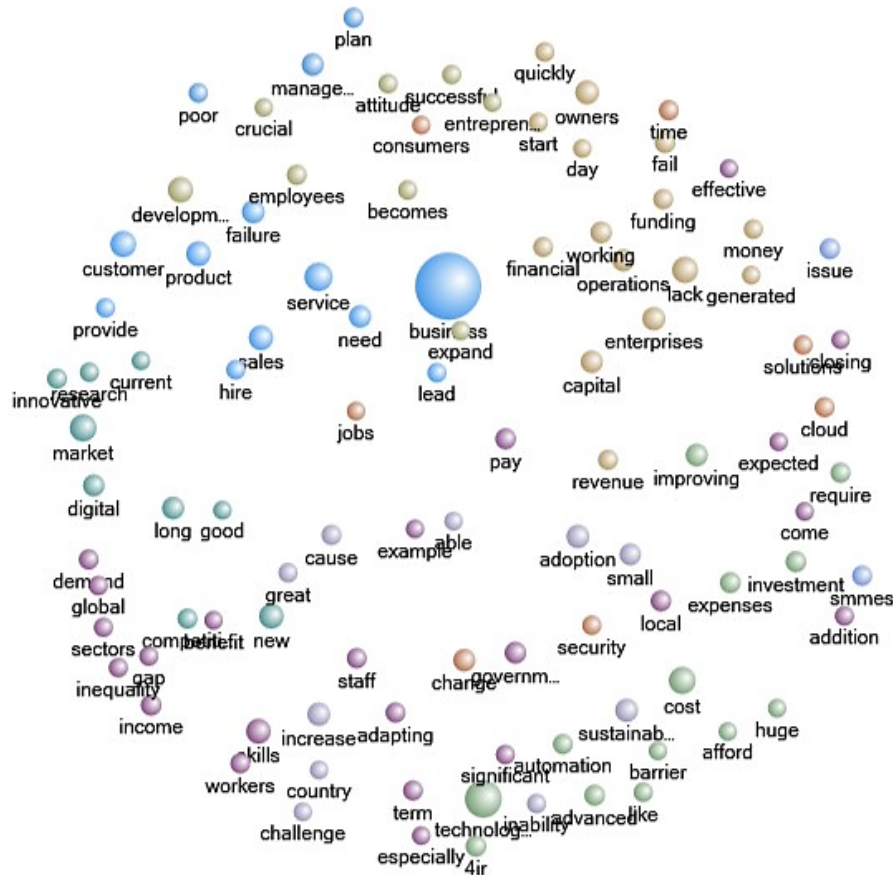


Fig. 1. Cluster analysis depicting challenges and disparities faced by SMMEs in the context of 4IR

3.2. Theme 2: Enterprise sustainability and adaptability in the 4IR. For SMMEs to remain viable, they must demonstrate resilience and adaptability, especially in the face of the rapid transformations brought about by the 4IR [36].

3.2.1. Financial challenges. A recurring theme was the financial challenges faced by SMMEs [37]. As Participant 5 detailed, «SMMEs, especially newcomers, face significant barriers in accessing financing due to their perceived high-risk nature». This sentiment was corroborated by Participant 1, who cited «insufficient capitalization and unstable revenue streams» as major roadblocks.

3.2.2. Lack of organizational structure. The relative newness of many SMMEs means they often lack the robust organizational structures that characterize established businesses [38]. Participant 2 observed that many SMMEs «lack robust performance management systems, distinct day-to-day operating models, and clear management structures».

3.2.3. External challenges. The broader economic environment also presents challenges. Participant 6 noted the adverse impacts of recent events: «Over the last three years, events like the COVID-19 lockdowns, the July unrest, and catastrophic floods have threatened the resilience and sustainability of SMMEs in KwaZulu-Natal».

3.3. Theme 3: Strategies to drive firm performance and development in the unstable corporate climate. In navigating the challenges of the 4IR, SMMEs require effective strategies and support mechanisms [39].

3.3.1. Government support and funding. The need for robust government support was a dominant theme. Participant 11 emphasized the importance of financial assistance from both local and national governments [40]. This was seconded by Participant 3, who stressed the need for government interventions in terms of «financial assistance and technological support».

3.3.2. Incentives for growth. There were calls for more incentives for SMMEs. Participant 11 suggested «providing tax incentives to promote sustainable business practices». This was echoed by Participant 3, who saw tax rebates as a potential catalyst for embracing 4IR technologies [41].

3.3.3. Infrastructure and transport. Infrastructure remains vital for SMME success [36]. Participant 2 highlighted the importance of efficient transportation systems, noting the government's role in ensuring the effective movement of goods and services.

3.3.4. Education and training. The role of education and training in equipping the workforce with the skills necessary for the 4IR was another recurring theme [11]. As the 4IR places a premium on digital skills, there were calls for more training initiatives tailored for SMMEs.

The insights from the participants painted a vivid picture of the challenges and opportunities faced by SMMEs in KwaZulu-Natal in the 4IR era. From grappling with the rapid technological shifts to navigating financial and infrastructural challenges, SMMEs are at a crucial juncture [9, 40]. However, with the right strategies and support mechanisms,

they have the potential to not only adapt but thrive in this new era [41]. The participant responses underscore the importance of a multi-pronged approach, encompassing government support, financial incentives, infrastructure development, and education and training, to ensure the sustained success of SMMEs in the face of the 4IR.

3.4. Practical usage and implication of the research.

This subsection elucidates the practical implications and broader applicability of the study's findings. It outlines how the research can serve various stakeholders, its relevance to other contexts, conditions for its application, and avenues for future research.

3.4.1. Utilization of research findings. The findings of this study offer actionable insights for a variety of stakeholders including policymakers, financial institutions, and educational organizations. For instance, the identification of financial challenges faced by SMMEs could prompt the development of tailored loan schemes or grants. The focus on digital literacy gaps could also guide educational institutions in curating specialized training programs [42].

3.4.2. Applicability to other countries. While this research is specifically concentrated on KwaZulu-Natal, South Africa, the challenges and opportunities highlighted are representative of broader trends in emerging markets. Countries with similar socio-economic landscapes may find the observations and recommendations transferable, albeit with localized adjustments [42, 43].

3.4.3. Conditions and restrictions for using these results.

The findings from this research are most relevant for regions with similar technological and infrastructural gaps, as well as similar financial constraints faced by SMMEs. Policymakers should consider the local context and adapt strategies accordingly for maximum effectiveness. The need for a multi-stakeholder approach, as emphasized in this study, is a universal recommendation but needs to be localized based on specific regional challenges [44].

3.4.4. Prospects for further research. The study opens up avenues for further research in several areas:

- Exploring the effectiveness of specific interventions aimed at bridging the digital divide for SMMEs.
- A comparative study involving SMMEs from different regions or countries to identify universal vs. localised challenges and solutions [45].
- Longitudinal studies to track the progress of SMMEs in adapting to 4IR technologies and to measure the impact of governmental and non-governmental interventions [46].

4. Conclusions

The 4IR presents both an opportunity and a challenge for SMMEs in KwaZulu-Natal and globally. While it offers the potential for business transformation, improved efficiency, and opening up of new markets, it simultaneously poses significant challenges, especially for smaller enterprises with limited resources and technological capacities. This study, through a comprehensive qualitative investigation, shed light on the lived experiences of SMME managers and owners in KwaZulu-Natal as they navigate the tumultuous waters of 4IR.

The findings underscore the need for a multifaceted approach to support SMMEs in their journey through this digital revolution. The challenges highlighted, ranging from a lack of financial resources, inadequate technical know-how, and the need for upskilling, are not merely individual firm issues but represent systemic gaps that need addressing at a provincial and national level. The significance of government support, both in terms of financial incentives and infrastructural development, is evident. Simultaneously, there's a pressing need for capacity-building initiatives, knowledge-sharing platforms, and collaborations to help SMMEs harness the potential of 4IR technologies.

Furthermore, the themes drawn from participants' responses emphasize the importance of adaptability, resilience, and innovation in navigating the complexities of the 4IR. While challenges are abundant, so are the opportunities for those who can strategically position themselves in this evolving landscape. As South Africa seeks to boost its economic growth and reduce unemployment, the role of SMMEs cannot be understated. By ensuring that these enterprises are equipped to thrive in the era of 4IR, we are not only investing in individual businesses but in the broader socio-economic fabric of the nation.

In closing, this study serves as a foundational exploration into the complexities faced by SMMEs in the context of 4IR in KwaZulu-Natal. It is hoped that the insights garnered here will inform policy decisions, spark further research, and inspire collective action to support and bolster the growth of SMMEs in this digital age.

Conflict of interest

The author declares that he has no conflict of interest in relation to this research, whether financial, personal, authorship or otherwise, that could affect the research and its results presented in this article.

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Data availability

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