

-RESEARCH ARTICLE-

THE EFFECTIVENESS OF THE 4IR TECHNOLOGIES IN ELEVATING SMALL-SCALE FARMING AT KWADLANGEZWA, KWAZULU NATAL IN SOUTH AFRICA

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—Abstract—

With the emergence of new technologies from the 1st, 2nd, 3rd, and 4th Industrial Revolutions, the productivity increase of agricultural and farming activities has been crucial to increasing yields and cost-effectiveness. Prior studies on the fourth industrial revolution (4IR) have focused on agricultural technologies but have ignored small-scale farmers. Before adopting the 4IR, the purpose of the study was to evaluate the agricultural challenges facing small-scale farmers. This work employed semi-structured interviews and a qualitative research methodology in which a literature analysis was conducted; it also described the occurrences of the aforementioned agricultural instruments. From the sample of 28 individuals, 86 percent were interviewed face-to-face, and 14 percent were interviewed through telephone. Seven percent of commercial and ninety-three percent of small-scale farmers were of African descent. The study employed discourse analysis to examine and analyze the spoken words and written texts to reveal the conversational sources of power, inequality, and bias from various farmer encounters. The study found that small-scale farmers lacked access to markets, capital, technology, and agricultural information and relied only on word of mouth. Further, the study investigated the ramifications of 4IR tools merging with small-scale farmers while

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underlining the importance of integrating modern 4IR technologies in agriculture while solving current issues. In Kwadlangezwa, KwaZulu-Natal (KZN), South Africa, this contributed to the identification and prioritization of the requirements of small-scale farmers, as well as the validation of the 4IR tools by the participants.

Keywords: Industrial revolution, 4IR, South Africa, small-scale farming, Qualitative Study

1. INTRODUCTION

The Third Industrial Revolution is enabled by internet technology that transforms the power of every continent into an energy internet that operates similarly to the Internet (Xu, David, & Kim, 2018). While 4IR technologies provide numerous prospects, their primary contribution is to the growth of technology and research. The 4IR characteristics also bring a range of cutting-edge technologies to large and small corporations and growing nations such as South Africa (Prettner & Strulik, 2020). Developed nations, such as the United States, have provided substantial assistance to agricultural firms in economic development. For the majority of farmers still mired in the second and third industrial revolutions, more access to renewable energy and internet connectivity, as well as financial inclusion, is necessary (Lele & Goswami, 2017; Xing & Marwala, 2017). South Africa's GDP fluctuates around 0.7%, which is much lower than countries such as the United Arab Emirates (1.3%), Brazil (1.26%), China (2.19%), Japan (3.36%), the Republic of Korea (4.81%), and Israel (4.95%) that have effectively implemented 4IR technology (Malomane, Musonda, & Okoro, 2022).

Incorporating agriculture into the industrial revolutions has proven to be extremely difficult. The well-known economist Klaus Schwab (Hwang, 2016) determined an explosion of internet-centric data flow, global competitiveness, and digital tools. The Fourth Industrial Revolution has gathered all of these technological characteristics together. There are physical autonomous vehicles, advanced robotics, 3D printing, and numerous other digitalization technologies. Moreover, IoT has been utilized to secure data storing to maintain daily updates concerning each mechanism (agricultural tools, tractors, or drones). According to the Soffel, these colossal changes are nothing compared to the prior technologies, but 4IR contributes to the rise of practical preparation, full-use application, and development while upgrading the present technology employed by farmers in South Africa. The 4IR is defined by farm management software unfamiliar to the majority of small-scale farmers, as well as precision agriculture and predictive data analytics; sensors used by farmers to collect data and monitor essential crop health, weather, and soil quality.

Due to the diversity of farming, some farmers have chosen to specialize in poultry; 4IR tools are useful for collecting animal data utilizing thermal imaging (software and hardware aimed at monitoring livestock, breeding patterns to genomics). Internationally, employing 4IR devices has reinstated robots and drones; smart irrigation for farmers.

Technology development will aid the next generation's farms by providing them with various farming techniques and allowing them to produce vast quantities for retailers (Engel & Barends-Jones). Once the 4IR technologies are completely operational and used in South Africa, climate change instances can also be removed. Moreover, natural disasters brought on by climatic change have manifested as water shortages and droughts in locations such as Cape Town and the Western Cape province (Banwell, Rutherford, Mackey, & Chu, 2018). One of the economists, Sen, the originator of Classical /Political Economics (Sen, 1985), viewed the free-market economy as a vehicle for capital expansion, securing property, expanding markets, and preserving the division of labor in society as one of the primary aims of the classical theory.

In contrast, the speed of 4IR tools is nothing compared to prior revolutions. As a result, it can lead to the loss of employment for small-scale and commercial farmers who increasingly rely on technological instruments rather than humans. The theory is well-formulated, but it will not serve its intended goal in South Africa, where the government makes decisions and not farmers.

On the other hand, developing nations anticipate dangers, such as the probable amplification of biases by artificial intelligence algorithms (Benton, Hazell, & Hill, 2017). According to Cooper (2015); Jensen and Barrett (2017), agriculture-based economies have relied on technological instruments for vast output, and developing nations have essentially eradicated poverty through the first, second, and third industrial revolutions since their introduction. The opportunity has arisen (4IR), and some small-scale farmers are eager to adopt and experiment with new agricultural technological equipment to feed the predicted expanding population of 9.8 billion by 2050. (Patel, 2012)

Despite the bright future of new technologies, small-scale farmers in South Africa face socioeconomic challenges such as poverty, drought, hunger, and inadequate compensation to support their small companies (Christiaensen, Rutledge, & Taylor, 2021; Nordin & Norman, 2018). This is reinforced by (Coble, Mishra, Ferrell, & Griffin, 2018). They assert that agricultural digitalization and automation will likely increase social, economic, and racial inequalities by completely implementing 4IR technology and phasing out traditional farming practices (Rotz et al., 2019). Agricultural equipment such as GPS, sensors, data modeling software, and automated technology such as driveless tractors, drones, and robots assisted farmers in improving agricultural output quality (Ncube, Mupangwa, & French, 2018). One cannot deny that farmers, including small-scale farmers, will use seeds, water, fertilizers, and pesticides more efficiently due to the information provided to them. Contrarily, some small-scale farmers lack essential technological agricultural skills and landscape dynamics knowledge (Gassner et al., 2019). Due to inadequate technological means, agricultural output in Sub-Saharan Africa has developed at a far slower rate than in other regions of the world (Giller, Hijbeek, Andersson, & Sumberg, 2021). According to N. Kingiri (2021), government

financial support in the South is insufficient to pay the costs of all daily agricultural activities and the development of small-scale farmers. However, 4IR technologies advocate the employment of technology in agriculture without regard for the actual situation of small-scale farmers. Before adopting the 4IR, the study's objectives determined the agricultural difficulties at hand and reflected on them. In doing so, the study highlighted the unique implications of the 4IR on small-scale farmers by comparing their current instruments with those of the 4IR and confirmed the potential implications of the 4IR on small farmers in KwaDlangezwa. In addition, the study assessed government and stakeholder financial support for small-scale agriculture, which resulted in specific recommendations about the new agricultural policies and agricultural sustainability in South Africa.

2. LITERATURE REVIEW

2.1 The 4th Industrial Revolution and Agriculture

The fourth industrial revolution had a huge impact on agricultural ICTs, and it also improved broadband availability, leading to a rise in "internet of things" implementation (IoT). It offers enhanced analytics, inexpensive equipment, and new applications to continue contributing to the digitization and digitalization of agriculture (Calicioglu, Flammini, Bracco, Bellù, & Sims, 2019). Digital technologies such as cell phones, drones, tablets, in-field sensors, and satellites are prominent in modern agriculture. They provide farms with several services, such as remote soil monitoring, improved water management, and animal and crop monitoring, all while mitigating the effects of climate change. Agriculture's value chain processes remain crucial to rural economic development initiatives. (Christiaensen et al., 2021; de Janvry & Sadoulet, 2020).

According to (Cronin, Fieldsend, Rogge, & Block, 2022), these have enabled farmers to plan more effectively and be more efficient, resulting in increased agricultural yields and animal performance while reducing inputs and labor expenses and enhancing profitability. As a result of digitalization, both the working conditions of farmers and the environmental impact of farming have improved. By interconnecting various devices, technology is now capable of automating cyber-physical systems. Industries are reaping the benefits of the increasing prevalence of electronically controlled machinery. Weltzien (2016) discusses how 4IR technologies have facilitated resilient communication technologies such as cloud computing and the Internet of Things. According to Malomane et al. (2022); Moloï and Marwala (2020) the Fourth Industrial Revolution will impact several commercial sectors in South Africa, Africa, and beyond. The 4IR has also introduced artificial intelligence (AI), big data analytics, and robotics, which are driving "Agriculture 4.0," or digital agriculture Ozdogan, Gacar, and Aktas (2017).

While "AgTech" is mostly utilized by and beneficial to large-scale farmers, it is unknown how knowledgeable small-scale farmers are about the system. According to [Berendt, Littlejohn, and Blakemore \(2020\)](#); [Lele and Goswami \(2017\)](#); [Lune and Berg \(2017\)](#), huge organizations, such as the agriculture industry, have previously utilized 4IR technology to enhance the activities of small-scale and commercial farmers ([Smidt & Jokonya, 2022](#)). Agriculture has expanded significantly in nations such as the United States, Israel, China, and India, pushing the limits of modernization ([Chapman et al., 2016](#)). The Netherlands is another nation strongly engaged in agricultural innovation and technological adoption ([World Health, 2017](#)). With technology breakthroughs, agri-tech has the potential to make farms more productive and efficient in the future ([Yang, Khoo-Lattimore, & Arcodia, 2017](#)). Farmers may now collect and monitor crop health using farm management software, precision agriculture, and predictive data analytics while obtaining meteorological and soil quality data. In addition to crops and increased yields, software and technology have been used to capture and regulate animal data to gain a deeper understanding of animals.

These agricultural technologies, including patterns, genetics, and intelligent irrigation, are more beneficial to large-scale farmers than small-scale farmers ([Naicker, 2017](#)). According to ([King, 2017](#)), the issues facing agriculturalists are posed by the current and future global food supply, which have lasted across time and will continue to push agriculture toward technological innovation. Because not every technological possibility will become a reality, it is essential to analyze it in light of global social, economic, and political shifts ([Hekkert, Suurs, Negro, Kuhlmann, & Smits, 2007](#)). Extreme automation and connectivity are the driving forces of the Fourth Industrial Revolution, influencing demographic shifts, globalization, macroeconomic trends, and more. Therefore, viewing the drivers of 4IR in agriculture only via a technology lens is insufficient and may fail to address the issues faced by small-scale farmers. According to ([Buseth](#)), the employment of 4IR technologies has introduced new agricultural working methods and contributed to long-term investments, making it possible for small-scale farmers to compete locally and internationally ([Phiri et al., 2020](#)).

According to [Hekkert et al. \(2007\)](#), individuals must have an adequate Networks and Information Learning foundation to engage in the change and adapt to it effectively. Farmers in Ghana, for instance, network via social media. This has impacted and improved the accessibility of numerous information links and agricultural technological advancements. According to [Weir and Knight \(2000\)](#), 88 percent of farmers who used technology to improve their agricultural communication were more likely to make positive agricultural decisions because they relate better when they share the same age, gender, and geographical area. [Lele and Goswami \(2017\)](#) contend that the absence of support for small-scale farmers adapting to new technologies to boost yields has hindered productivity development in African nations, such as South Africa.

According to [Sen \(1985\)](#), development is a process of progress that aims to meet the present generation's requirements without endangering future generations' ability to do so. Consequently, there are various open questions regarding the adaptation of technical techniques and sustainable agricultural development that consider local diversity (small-scale farmers). Unlike their commercial counterparts, agriculture and rural development have not been viewed as local issues to strengthen and empower small businesses. According to [Pretty \(2018\)](#), small-scale farmers lack efficient communication, transmitting, and sharing of agricultural information via mobile devices.

Due to financial limits, not everyone, especially small-scale farmers, has access to digital agricultural equipment. Despite widespread recognition of the possibilities of digitization and data for agriculture, small-scale farmers continue to lag and struggle to acquire relevant technologies ([King, 2017](#)). Although 4IR technologies such as artificial intelligence and robots may augment and improve old working procedures, they may also displace many jobs in the services sector and labor-intensive industries ([World Health, 2017](#)). Previous revolutions improved agriculture and increased output, but never at the expense of agricultural workers' livelihoods. People from rural areas have worked in the agriculture sector for decades. The advent of 4IR, on the other hand, has led to the development of robust farming equipment. As a result, less labor is required to do agricultural activities than in the past. In agriculture, drones, electronics, tractors, and an unlimited number of 4IR technologies have replaced humans. Powerful and technologically advanced agricultural materials significantly impact job losses in the farming industry. As a result, there is significant concern and skepticism over the government's willingness to ensure that small-scale farmers may also benefit from the 4IR ([Moloi & Marwala, 2020](#)).

2.2 The Features of The 4IR

The preceding [table 1](#) detailed several 4IR technologies that are useful for various businesses but especially pertinent to agricultural industries' development. The 4IR technologies are not limited to only commercial, emergent, or small-scale farms. The objective of the 4IR characteristics is to boost production by utilizing more technology than in previous revolutions and practices. Farmers in KwaDlangezwa cultivate sugarcane, poultry, and fruits and vegetables. Although farmers may produce various products, they can adopt and use the 4IR to boost their output according to their priorities.

According to [Barlow \(2018\)](#), the purpose of agriculture in each developing nation was to fulfill three fundamental roles in an era of industrialization: to increase production and productivity to feed the growing non-agricultural population; to prepare a large and growing surplus of potential workers for towns and industries and to provide a mechanism for the increase of capital to be used in the more modern sectors of the economy.

Table 1: Emerging Technology Description

Artificial intelligence	Artificial intelligence is a system distinguishing complex patterns, processing information, drawing conclusions, and making decisions.
Big Data analytics	After using Artificial intelligence, decisions are based on accurate information, such as tracking hidden patterns and market trends and, most importantly, enabling customer preferences.
Blockchains	Blockchains are convenient for food security and enable food to be traceable using systems for international trade, such as including digital records of crop storage in warehouses available and secured before the selling point.
Fifth-generation wireless (5G)	Farmers interact at different levels and use the latest technology, high speed, and responsiveness of wireless networks to connect with other agriculturalists worldwide.
The Internet of Things (IoT)	This system of interrelated human-to-computer interaction is not limited to farmers as they can communicate via the IoT to capture more innovative data about agricultural technologies.
Autonomous vehicles	Driverless vehicles are more beneficial (e.g., tractors), especially in convenient landscapes and huge farmers with countless hectares, as they are monitored by mobile devices to perform agricultural activities.
Drones	Drones are mostly handy, as they are uncrewed flying vehicles that are remotely controlled and available at different prices and sizes. It is easy to monitor crops and soil conditions while collecting data in big and small plant fields.
3D	Generally, some working tools or fabrics are imported and take time to arrive from the date of purchase. By using the 3D, Farmers have been introduced to a better way to purchase fabricated small agricultural machines.
Robotics	Robots are not only limited to big firms but also contribute to massive agricultural output. Robots are machines designed to perform different tasks, automatically eliminating human error with speed and precision.
AI-Machine learning	AI-Machine Learning helps with automatic plant management and soil and weather conditions monitoring.

Source: (Duckett et al., 2018).

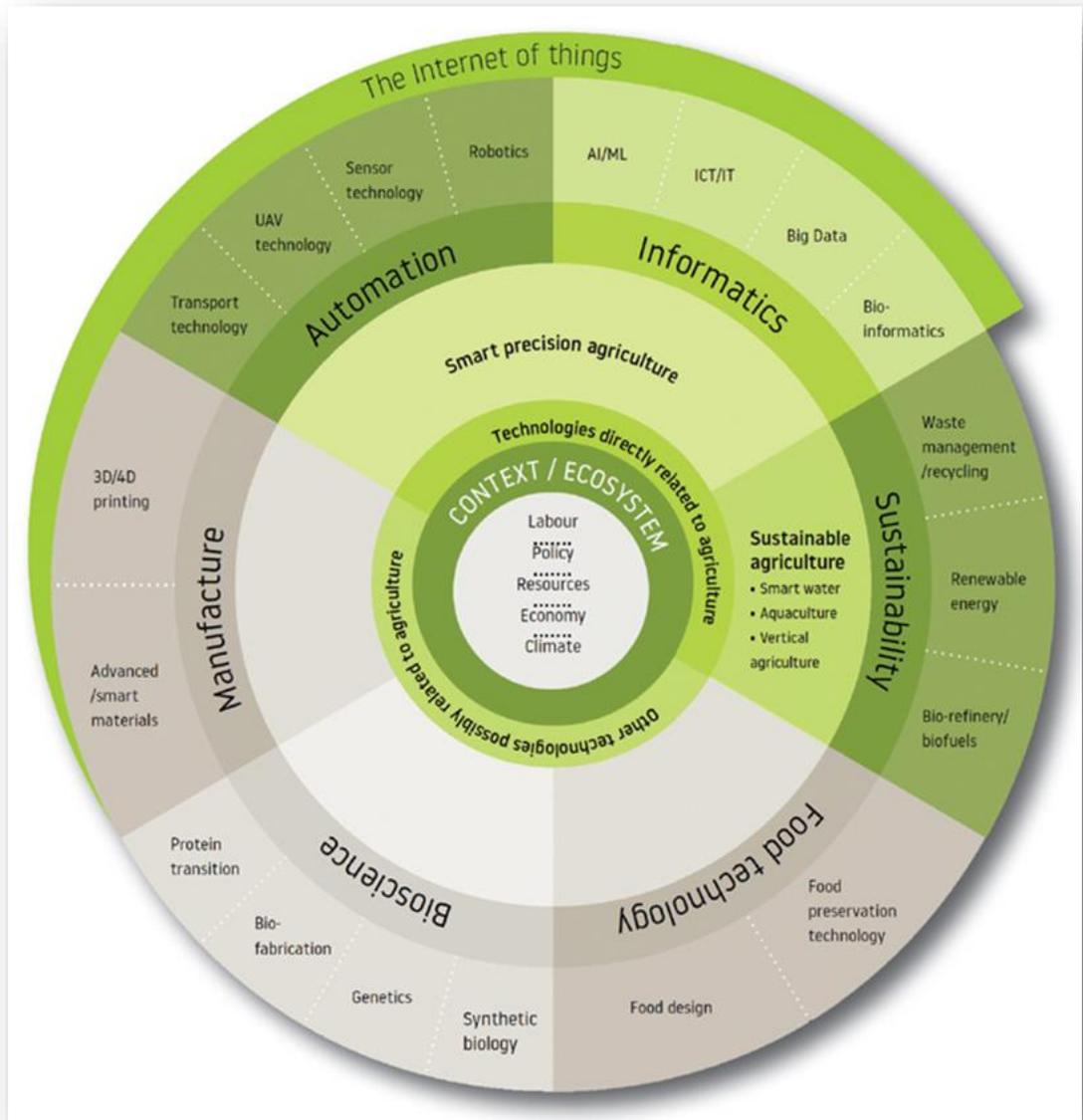


Figure 1: Technologies, systems, and applications in agriculture.
Source: [WCDoA, 2018](#)

After 1994, South Africa's agricultural policies were developed to fully assist commercial and small-scale farmers ([Zantsi, Greyling, & Vink, 2019](#)). In addition, government institutions such as the Department of Agriculture, the Land Bank, and the Agricultural Research Council formulate agricultural policies to satisfy the needs of commercial and small-scale farmers in their everyday agricultural activities ([Calicioglu et al., 2019](#); [Chapman et al., 2016](#)).

2.3 The Fourth Industrial Revolution: Implications for Different Industries

The Fourth Industrial Revolution (4IR) began as a continuation of the twentieth century's first, second, and third revolutions (Allal-Chérif, Simón-Moya, & Ballester, 2021). According to (Erboz, 2017), the 4IR is a collective term for value chain organization technologies. It aims to develop more digitized systems and network integration through smart systems and increase business connections. In addition, all fields and sectors of life have been integrated into the 4IR. Virtual worlds, smart cities, big data, the Internet of Things (IoT), and artificial intelligence (AI) are some of the 4IR technologies that have been touted as the most significant innovations of the new era.

According to Xu, David, and Kim (2018), the 4IR surpasses past revolutions because of the convergence of emerging technologies and their interaction across the physical, digital, and biological domains. The Fourth Industrial Revolution is a new system that threatens to displace the current system of completing tasks with human labor by utilizing more machines/robots (ibid). Cyber-Physical Systems (CPS), Artificial Intelligence (AI), three-dimensional (3D) printing, robotics, blockchain technology, cryptocurrency, and quantum computing (Erboz, 2017). According to Skilton and Hovsepian (2018), these innovations have transformed past methods of utilizing materials and products while expanding services. According to Xu et al. (2018), the speed and fusion of 4IR technologies on the physical, digital, and physical planes are different. On the other side, Agbehadji, Awuzie, and Ngowi (2021) emphasizes that people lack information and understanding of the first three industrial revolutions, which will make it more difficult for them to adopt the fourth industrial revolution.

Small-scale farmers also produce horticultural products, which is significant for employment and revenue generation in South Africa, especially in rural and peri-urban areas. According to Daff (2013), horticultural products contributed 25% of the total gross value of agricultural production in 2012, including citrus exports worth R7.9 billion, wine exports worth R6.9 billion, apples, pears, and quinces exports worth R5.2 billion, and grape exports worth R4.6 billion, with the majority of these exports coming from large-scale commercial producers. However, integrating small-scale farmers to benefit from and participate in export opportunities remains challenging.

One may argue that a lack of technology is one of the most significant contributors to society's issues. As a result, societies are afflicted with high unemployment, gender inequality, high poverty rates, a lack of education, and inadequate health services. Moreover, government initiatives have failed to establish adequate platforms for global partnership and rural and urban development (Moloi & Marwala, 2020). According to Lele and Goswami (2017), the 4IR has far-reaching implications on all parts of people's lives and how they engage with one another through technology and working procedures while exchanging talents and knowledge.

Even highly qualified people will be threatened by the Fourth Industrial Revolution since their jobs will become precarious shortly due to corporate automation and the introduction of robots (AI). According to [Xu et al. \(2018\)](#), employees will be replaced by computers and machines in many industries because robots can do human jobs in less time and at a lower cost. This creates issues for the global educational system. The Fourth Industrial Revolution and other impending revolutions will demand more graduates who are prepared to work with robots and improve their skills ([Etikan, Musa, & Alkassim, 2016](#)). One could claim that the 4IR will harm median earnings, widening civilizations' economic gap.

Developing country agricultural investment and productivity are generally weak in terms of physical capital and growth compared to developed country investments in technology and human capital ([Sabodash et al., 2021](#)). Moreover, the other elements that affected growth were the regulatory environment, political stability, and the depletion of natural resources - problems that farmers face. This instance is distinct because commercial input is well-established or supported by large machines and sufficient fertilizers. [Chavas \(2001\)](#) argued that developing countries employed similar technology in the early 1990s as they did in the early 1960s, demonstrating that agricultural improvement depended on inputs other than improved technology, such as fertilizer and pesticides. However, [Ortiz-Bobea, Ault, Carrillo, Chambers, and Lobell \(2021\)](#) stated that labor, capital, and land productivity improvements were advantageous and influenced agricultural productivity. To increase output, agricultural productivity growth depends on three factors: labor, capital, and land. Public and private investment is generally required to boost agricultural production for both large-scale and small-scale farmers ([Reaves, 2019](#)). According to [McMichael \(2013\)](#), the Fourth Industrial Revolution favored agriculture via the value and agro-processing chains. Additionally, agricultural processes will be enhanced, resulting in higher output and decreased expenses. The 4IR will benefit South Africa by creating opportunities for agro-processing expansion. However, rural areas in Africa continue to be much poorer than urban ones ([Beegle, Christiaensen, Dabalén, & Gaddis, 2016](#)). According to the [World \(2016\)](#), 80% of underprivileged people reside in rural areas, 64% work in agriculture, and 44% are 14 or younger, demonstrating that child labor is still prevalent in developing nations ([Graf & Oya, 2021](#)).

Southern Africa As a result of their low yields, small-scale farmers have a more difficult time qualifying for financial support. Commercial banks are the primary sources of credit [Popoola, Yusuf, and Monde \(2020\)](#), and they favor clients who can offer collateral in the form of property and proof of employment in the form of a paystub. Due to their inconsistent yields, small-scale farmers in KwaDlangezwa have been unable to acquire loans for decades, according to the report.

According to [Berendt et al. \(2020\)](#); [Cochrane \(1958\)](#); [Giller et al. \(2021\)](#); [Hekkert et al. \(2007\)](#); ([Hwang, 2016](#)), there is rising fear that the deployment of massive agricultural

technologies could lead to job losses. [Giller et al. \(2021\)](#) states that around 35 percent of current employment skills will change shortly. Consequently, new skill sets will be required for the 4IR and the use of new technologies. There will be job displacements as 4IR technologies generate new employment opportunities and boost output [Nordin and Norman \(2018\)](#). According to [Hekkert et al. \(2007\)](#), the new 4IR technologies can potentially displace more workers than ever before.

According to [Lune and Berg \(2017\)](#), many businesses use 4IR technologies, and most industries are satisfied with the product; nonetheless, small businesses utilize current technology less frequently than huge organizations. Computers and digitization will likely eliminate low-skilled, low-paying jobs in huge organizations. Depending on the nature of the work, higher-paying jobs are still in demand, and highly skilled workers are less likely to be replaced by robots ([World, 2016](#)). Using advanced technologies instead of human labor has widened the divide between commercial and small-scale farmers ([Lee, 2018](#)). The focus of the study was on the effectiveness of 4IR and small-scale farmers in the three categories of sugarcane, poultry, and fruits and vegetables in KwaDlangezwa, KwaZulu-Natal.

3. RESEARCH METHODOLOGY

For this study, the qualitative and exploratory research design was appropriate. The qualitative research approach includes procedures for collecting data from documents, texts, noises, and interviews ([Etikan et al., 2016](#)). Therefore, for this particular study, a qualitative and exploratory research design was employed to expand the current literature on the implications/facts of 4IR and the development of small-scale farmers. The data collection method consisted of collecting primary data from participants via unstructured interviews with open-ended research interview questions. The sample consisted of 28 individuals. 24 students were met, face-to-face interviews were performed effectively, and 4 were conducted over the phone. In this study, the sample was selected using the purposive sampling method, whereby the participants were well-known and purposefully chosen to participate due to their relevance to the issue. Using semi-structured interviews, the study elicited comprehensible responses from the participants. The semi-structured interview allowed for in-depth questioning. Discourse data analyses were employed for data analysis and interpretation since they were more appropriate for the study; themes and coding were also a part of the process. After data collection, data analysis and interpretation assist in organizing the study's findings ([Creswell & Clark, 2017](#)).

4. THE FINDINGS OF THE STUDY

This article's primary objective was to examine the consequences of the 4IR for small-scale farmers producing various agricultural products in KwaDlangezwa, as well as the urgent need to embrace the 4IR. Also, the results demonstrated that, although farmers in

KwaDlangezwa contribute to the farming industry, they are pursuing distinct goals. Older farmers are not enthusiastic about adopting 4IR technologies because they view the devices as more complex than the tools they possess. Younger farmers, on the other hand, were enthusiastic and interested in acquiring the newly introduced agricultural technical gear. Also contributing to the skepticism of older farmers towards 4IR tools was their limited financial resources. The findings are ranked according to the technological demands of the participants or most pertinent to individuals such as (a) sugarcane producers, (b) poultry farmers, and (c) fruit and vegetable farmers.

4.1 Assessing the Perceptions of Small-Scale Farmers Concerning the Implications of the Fourth Industrial Revolution, and Its Benefits to Their Output

4.1.1 Sugarcane Growers

Although 95 percent of sugarcane growers were over 50, they were passionate about their profession. Even though they still rely on traditional farming methods, they were receptive to the benefits of 4IR technologies for increased yield. One participant disclosed, "Since 1996, I've been utilizing the same working gear and employing others to complete some tasks. Without a doubt, commercial farmers will benefit more from this technological revolution, but small-scale farmers have significant obstacles that must be addressed before implementing 4IR technology. Small-scale farmers acknowledged that the 4IR tools are useful but questioned their efficacy in elevating them. Other participants remarked that even the first, second, and third technical breakthroughs were more advantageous to small-scale farms than small-scale farmers. Moreover, they emphasized that the concept of improving technology is fundamental and crucial for boosting food production. Without a doubt, the founder's technology and science developed these machines on purpose to keep up with population and food needs. Most sugarcane farmers were eager to experiment with 4IR technology to increase agricultural productivity. Despite this, older sugarcane farmers expressed similar concerns around affordability, as they do not generate much revenue and how they will maintain the 4IR instruments without the required skills and experience. According to Moloj and Marwala (2020), the 4IR's emerging technologies pose a growing threat to conventional employment opportunities and erode some industries.

4.1.2 Poultry

As agricultural activities vary, farmers' responses were based on their daily activity and not in general. Farmers who dealt with animals shared scant details about the 4IR's implications. According to a younger farmer, the 4IR will eliminate the spread of diseases and stabilize food security in KwaDlangezwa. Indeed, the introduction of 4IR will be a tremendous weapon for altering the practices of our ancestors. Not that they are no longer relevant, but the times have changed, and the use of injections and poisons to kill ticks is not the only answer to the present and future agricultural difficulties. In

addition to what the participant stated, other farmers were already utilizing incubators as part of modern technologies. To conclude, it is an issue of affordability and proficiency among other farmers in KwaDlangezwa. Transformations in agriculture are brought about by technological progress (Xing & Marwala, 2017).

4.1.3 Fruit and Vegetables

Farmers in KwaDlangezwa who cultivate fruits and vegetables cultivate produce in modest quantities. For this reason, the majority of homes possess a variety of fruits and vegetables grown by farmers. Avocados, oranges, apples, bananas, tomatoes, and potatoes, to name a few, are all difficult to acquire unless a farmer is selling their produce on the side of the road. As a result, these farmers were distinct from the rest, as their demands centered on marketing and exporting rather than using more modern gear. Berendt et al. (2020) assert that it is crucial to comprehend the advantages and disadvantages of 4IR technologies. For the benefit of farmers, this allows them to use newly developed technical equipment with discretion. Small-scale, younger farmers, were optimistic and pleased with the agricultural improvement. In addition, farmers in KwaDlangezwa were aware that they would not benefit equally from using the 4IR prior to addressing and prioritizing their agricultural needs to produce more goods.

4.2 Evaluating Challenges Faced by Small-Scale Farmers at KwaDlangezwa

4.3 Sugarcane Growers

The terrain in KwaDlangezwa is mountainous and hilly, making it difficult to employ driverless tractors. Some locations can accommodate tractors, but most are not level. Over the years, farmers have hired individuals to undertake agricultural tasks from input to product. The participants noted, "challenges are an integral part of our everyday operations, from the day of planting to the day of harvesting, and even after harvesting. Due to their origins outside of South Africa, it is difficult to retain employees over time. New employees bring new working techniques, resulting in a significant loss of output while also requiring additional compensation. Sugarcane is the product requiring the most expertise and talent. As for McMichael (2013), progress entails several changes, some of which are not readily absorbed at first. The same 4IR technology and methods have been effective for large-scale farmers. Yet, small-scale farmers faced difficulties with harvesting; they rented trucks and tractors for the first conveyance and stored the produce in an area known as the "Payindini storage area." There is no shelter or security, and residents occasionally steal sugarcane. The longer it is stored there, the more sucrose (sweetness) is lost, resulting in a fall in profit once the product reaches Felixton Mill. As farmers, we rely on a limited number of trucks and tractors. As a sugarcane farmer, additional acreage is required. Because most farmers own fewer than 4 hectares, they cannot expand their working areas. In addition to these obstacles, farmers use insufficient fertilizers to cultivate equal sugarcane. When proper processes are followed during plowing, the resulting crops are high quality and profitable. Small-scale

- ✓ Ucelemba (pang) to cut trees before hiring a tractor to plough
- ✓ Igeja (Garden hoes), spades, wheel hoes, seeds, trenching shovels, and broad forks.
- ✓ Small-scale farmers are used to hiring tractors they do not own, Loli (truck) and Manyolo (fertilizer), which range between (R400, R500, and R600) which is expensive.

4.4 Poultry

As for poultry farmers in KwaDlangezwa, they faced obstacles distinct from those of sugarcane farmers. Farmers highlighted their difficulties and obstacles in expanding their businesses. Farmers stated, "There are times when buyers order available breeds; that is not a significant loss, but we incur a loss when we have requested a specific product, and the buyer is nowhere to be found." On the other hand, because Dlangezwa is situated in a rural location, most of its clients are locals; if not for the locals, the goods go unsold. For this form of the farming business, there is a marketing and supply chain deficiency. The firm can potentially expand by offering more breeds desired by major stores.

Furthermore, the application of 4IR technologies may be more suitable for developing small-scale farmers in KwaDlangezwa. Developed and developing nations have attempted to keep up with the rapid pace of revolutions and shifting circumstances, which need inventive and adaptable business sector knowledge in all aspects. (Yang et al., 2017)

4.4.1 Fruit and Vegetables

Farmers who produce fruits and vegetables but do not generate a profit do not consider themselves to be farmers. A small-scale farmer added, "What we produce is limited, and we distribute the remainder to households after selling a modest quantity." The issue is that most products must be stored in cold rooms at a specific temperature. We sell the goods to locals, including students and inhabitants of KwaDlangezwa. Before the Covid 19, the University of Zululand let farmers display various fruits and vegetables beneath tents for students, employees, and community members. All of that has ceased, and the product is no longer profitable. Even if they could afford the latest instruments, small-scale farmers did not benefit from the usage of 4IR technologies based on their products and tools. Small-scale farmers in KwaDlangezwa will be able to utilize agricultural technologies shortly if they obtain sufficient financial assistance from the government and other stakeholders. In addition to financial difficulties, 90% of small-scale farmers were illiterate and over 45 years old. Education is crucial to one's knowledge and abilities (Reaves, 2019)

4.5 The Effectiveness of Government and Stakeholders' Financial Support for Small-Scale Farmers at KwaDlangezwa

The Department of Agriculture and Felixton Mill provide sugarcane farmers with equipment to enhance their products. The Department of Agriculture in eMpangeni and Richards Bay collaborates with the government to enhance farmers' agricultural activities. From sugarcane producers to farmers of poultry, fruits, and vegetables, the government has open and operational platforms to supply services and support new farmers. These organizations give the essentials needed to establish a farming business, as they are thoroughly aware of the current issues. The route towards fully using 4IR technological instruments will take longer, as even the government cannot afford to purchase such powerful tools. Commercial farmers can purchase most agricultural equipment due to their lucrative relationships with large retailers.

Also, the data found that most farmers are illiterate, making it difficult for them to connect with farmers from other regions, except their neighbors and close friends. There are numerous ways to improve skills and knowledge while embracing new technology. According to the paper's findings, small-scale farmers cannot fully participate in the 4IR and other technological developments due to a lack of infrastructure, low levels of literacy, and an absence of appropriate information services, all of which contribute to the insufficiency of technical skills. The literature demonstrates that some small-scale farmers in distant areas lack access to vital information and digital technology infrastructure and struggle to communicate with key agricultural value chain actors.

5. DISCUSSION

This article explored the effects of 4IR technologies on the growth of small-scale farmers in KwaDlangezwa. The 4IR agricultural instruments are not a continuation of earlier technologies or revolutions; rather, they are something entirely new that is incredibly fast—introducing the age of robots and large machinery. Similar machines transmit vast amounts of data. Large robots apply to the agricultural systems of commercial, small-scale, and emerging farmers. Depending on their fields of specialization, the 4IR traits can also boost farmers' abilities and knowledge at different levels. Existing issues such as land distribution, ecological/environmental problems, and a lack of money and technology accessibility must be addressed before implementing improved working equipment. The findings found surprising present and future obstacles and propose potential solutions for growing and increasing small-scale agriculture in South Africa.

6. Recommendation

The following recommendations are made to practitioners by the present study:

- Farmers (commercial and small-scale/emerging) must possess a SA (GAP) certificate and a Poultry certificate to have the opportunity and suitable platform to sell their products to large merchants.
- Resolve land concerns and implement creative land policies to address South Africa's agricultural difficulties.
- The policies of small-scale farmers in South Africa should be based on long-term, reliable marketing contracts. They are permitting farmers to collaborate.
- The government and relevant parties should develop formal contracts for feeding programs that work directly with small-scale farmers.
- Innovative bank policies to aid in the provision of loans to small-scale farmers. For agricultural policies that address existing concerns, such as digital technologies, while boosting productivity growth and sustaining utilization of land, market, water, and biodiversity resources.
- Prepare small-scale farmers for the future benefits of adopting digital technologies through education and training.
- Market accessibility and the opportunity to generate new jobs.
- Supplying farmers with comprehensive assistance until they are well-established.
- Technical and advising help, and regulatory services for machines
- Create and deploy additional marketing and small business growth strategies
- Financial assistance primarily for small farmers

7. LIMITATIONS

There are nine provinces in South Africa, all of which rely on agricultural activity and output. KwaDlangezwa, where agriculture is extensive in South Africa, was the location of the study's flaw. The study was limited by the fact that during data collection, most farms were closed due to the influenza epidemic. The study may have been comparable to other regions or provinces. However, laws during the epidemic made it impossible to collect data from other locations and travel great distances without work permits. The small-scale farmers in KwaDlangezwa were eager to learn more about the 4IR. They expressed concern over the slow progress and concentration on financial, market, and other agricultural challenges. Small-scale farmers in KwaDlangezwa are similar to other farmers in developing nations; they are elderly, engage in agriculture for personal consumption, and sell a few products to purchase bread. Older small-scale farmers lacked literacy and understanding of the first, second, third, and fourth industrial revolutions. In KwaDlangezwa, the small-scale farmers still used antiquated agricultural

equipment for their daily duties. Before bringing new technology, the study may, in the future, examine and uncover new techniques to improve the old tools used by farmers; most importantly, the study may introduce business. When farmers acquire SA (GAP) certifications, they no longer produce on their own but instead form organizations that specialize in producing a specific product and have a functional supply chain (marketing).

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