



**TITLE:**

**THE PLACE OF THE FOURTH INDUSTRIAL REVOLUTION IN SMALL-  
SCALE FARMING IN KWADLANGEZWA, KWAZULU- NATAL, SOUTH  
AFRICA**

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## DECLARATION

I, Thabisile Luyanda Mtshali, declares that;

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Date: 29/11/2021

## **DEDICATION**

This dissertation is dedicated to my late mother, Ntombizodwa Eunice Mtshali who passed away on 20 August 2003. You are dearly missed, “Mazeet”

## **SPECIAL ACKNOWLEDGEMENTS**

- I sincerely appreciate, my passionate, encouraging, intellectual, hardworking and compassionate supervisor Prof Nokukhanya N. Jili. Your presence, role and guidance had a great impact on the study itself as I felt your enthusiasm, from the beginning to the end of the study. You made it easy to work together, and always uplifted my spirit to achieve more and become a better person.
- Extended acknowledgement is also passed to my family and friends; I am always grateful for your endless love and support.
- Lastly, I would like to thank the National Research Fund (NRF) for funding my study and contributing to the great success of this study.
- I can firmly affirm that the Lord has been good to me. I am humbled and astonished by what the Lord has done for me in all my academic years. Without God's plan, (Jeremiah 29:11) I would not have made it this far. Hence I am passing on my gratitude to God who has made all this possible. He has been my rock and my resting place. His presence in my life has proven that he is a God of possibilities and he breaks all the protocol for his mercy and grace and kindness which He manifests in our lives.

## **ABSTRACT**

The study's goal was to give a broad picture of the effects of agricultural growth that focuses on optimum output by utilising 4IR agricultural instruments. While acknowledging the role played by government in increasing agricultural manufactured goods. As for the national and provincial departments of agriculture (DOA) of the South African government made concerted efforts after 1994 to implement policies and programmes targeted at making the country's agricultural industry stronger and more robust. Increased equity among farmers in terms of racial and gender representation, as well as access to land, modern technologies, and other inputs, was critical to this strategy. As the process progressed, it was met with criticism from a variety of areas. Many post-1994 policies and programmes, including the 1995 White Paper on Agriculture, the 1998 Agricultural Policy in South Africa discussion document, the 2001 Strategic Plan for South African Agriculture, and the 2004 Comprehensive Agricultural Support Programme have exemplified the criticism that there is an obvious shift away from supporting the poor and more vulnerable farmers, particularly female farmers, towards an overwhelming focus on the better off.

The implications of the 4IR and small-scale farmer development in KwaDlangezwa were investigated using the theoretical framework of the classical/political economic and capacity approach theories. Traditional leaders, commercial and small-scale farmers, the manager at Felixton Mill, lecturers at Owen Sithole College (Vice Principal and students), and community people were interviewed using a qualitative technique in which twenty-four in-depth interviews were conducted. The study further conducted four telephone interviews with Department of Agriculture officials, University of Zululand lecturers (The Physics department is in the Faculty of Science & Agriculture) and Agriculture Research Council (researcher). Farmers require not only land, but also education, technology that is appropriate for their farming needs, and proper agricultural extension support, according to the study's conclusions. Small-scale farmers in South Africa can use digital technologies to overcome some of the barriers that prevent them from participating in economic development. However, the adoption of digital technology by small-scale farmers faces major hurdles and limitations.

This study adds to the digital development literature in three ways: it presents the technology(4IR), the political and social variables influencing digital adoption in small-scale farming in KwaDlangezwa. It also adds knowledge to the analytical value of the capacity approach and 4IR technological adoption by small-scale farmers under five categories: economic, political, social aspects, institutional and governance. Through three interconnected sets of technologies, namely automation, additive manufacturing, and the Industrial Internet, the Fourth Industrial Revolution (4IR) is having an impact on South Africa's industrialisation possibilities. The ramifications of the 4IR were examined in this research, including the potential and challenges that the 4IR poses for small-scale farmers in KwaDlangezwa. The agricultural sector has experienced job losses and sugarcane growers' productivity has declined.

Products-as-services, the sharing (collaborative) economy, and digital services and digital exports for small-scale farmers, on the other hand, are among the potential. The study's findings revealed that in order for small-scale farmers in KwaDlangezwa to benefit from 4IR agricultural instruments, they must enhance their entrepreneurship, education, land issues, market value chain, and finance scheme policies. In South Africa, small-scale farmers have been identified as a vehicle for achieving poverty reduction and rural development goals. To realise this potential, it is necessary to comprehend the diversity of small-scale farmers in order to create effective policy interventions. The findings also highlight the importance of social grants, particularly old-age pensions and child assistance payments, which have aided most small-scale farmers in KwaDlangezwa in sustaining their agricultural activities. According to additional information, only a small number of households can market their produce without the use of digital technology, which impedes business growth.

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## LIST OF ABBREVIATIONS AND ACRONYMS

1IR	First Industrial Revolution
2IR	Second Industrial Revolution
3D	Three-dimensional Printing
3IR	Third Industrial Revolution
4IR	Fourth Industrial Revolution
ACP	African, Caribbean and Pacific
AfDB	African Development Bank
AI	Artificial Intelligence
BATAT	Broadening Access to Agriculture Trust
CBN	Central Bank of Nigeria
DAFF	Department of Agriculture, Forestry and Fisheries,
DEA	Data Envelopment Analysis
DFID	Department for International Development
ECA	Economic Commission for Africa
EDD	Economic Development Department
FAF	Financial Aid Fund
FAO	Food and Agriculture Organisation
GDP	Gross Domestic Product
ICTs	Information and Communication Technologies
IoT	Internet of Things
MFP	Market Facilitation Program
NAMC	National Agricultural Marketing Council
NPC	National Planning Commission
OA	Old Age Pension
OECD	Organisation for Economic Co-operation and Development
SA	South Africa
SAHRC	South African Human Rights Commission
SSA	Sub-Saharan Africa
Stats SA	Statistics South Africa
STEM	Science, Technology, Engineering, and Mathematics

TFP	Total Factor Productivity
UN	United Nations
VAT	Value Added Tax
WEF	World Economic Forum
LRAD	Land Redistribution for Agricultural Development
MAFISA	Micro-Agricultural Financial Institution of South Africa
CASP	Comprehensive Agricultural Support Programme
IDC	Industrial Development Corporation
SEDA	Small Enterprise Development Agency
ECDC	Eastern Cape Development Corporation

# **CHAPTER ONE**

## **INTRODUCTION AND OVERVIEW OF THE STUDY**

### **1.1 Introduction**

For essential developmental purposes, industries have adopted various technologies in the past decades. Globally, the progress and innovation taking place are a result of the revolution in science and technology. Most industries partake in and improve production by using more advanced technological systems (Schwab 2017). Such technologies are continually being enhanced and modified for greater efficiency and sufficiency demands that come with a growing global population. In current times, such technologies are commonly discussed within a Fourth Industrial Revolution (4IR) mindscape. The Fourth Industrial Revolution (4IR) is associated with massive digitalisation, connectivity, and new scientific discoveries running through industries to improve the speed, quality and extent of production (Schwab, 2017). For several reasons, the previous revolutions in terms of their economic, social and political speed and breadth were nothing compared to the 4IR characteristics (Clayton, Christensen, Michael, Raynor and McDonald, 2015).

Currently, billions of people are connected to mobile devices as a result of progressive technological facilities and complex data storage systems worldwide (Schwab, 2017). To list a few innovations from the vast 4IR coverage it is a wide-ranging technological dimension incorporating robotics, artificial intelligence (AI), autonomous vehicles, the internet of things (IoT), 3D printing, biotechnology, materials science, quantum computing and advanced energy storage. As asserted by Schulz, Gott, Blaylock, and Zuazua (2018:22), one of the outcomes of 4IR is perceived as a movement from labour-intensive to knowledge and skills-intensive production for industries. The agricultural industry is part of these worldwide developments. Internationally, small-scale farmers exhibit a slow adoption rate of agricultural technologies (Du Toit, 2007). This also applies to the previous, pre-4IR agricultural technologies that have been beneficial in

enhancing agricultural production. It is well noted that small-scale and commercial farmers contribute to economic growth in both developed and developing countries. The Food and Agriculture Organization (FAO), an agency of the United Nations reports a general increase in technology use in the agricultural sector (FAO, 2017). 4IR technologies include the use of tablets, smartphones, in-field sensors, drones and satellites as appropriate tools for better output. Extensive communication platforms that come with 4IR's massive and progressive technologies, such as artificial intelligence (AI), robotic technologies, cloud computing and IoT, and big data analysis are part of dynamic digital agriculture (Ozdogan, Gacar and Aktas, 2017). Innovations such as the remote measurement of soil conditions are effectively contributing to efficient ploughing, improved water management and easier crop monitoring using technological devices (Weltzien, 2016). One may argue that the use of agricultural machines requires certain innovation and skills/knowledge, which applies to other business sectors too (*ibid*). Digital technologies enrich crop yields while reducing hard labour for employees and positively contributing to profit-making (EIP-Agri, 2017). These technologies have therefore helped to improve both the quantity and quality of agricultural output.

Nevertheless, the digitalisation of the agricultural industries and the introduction of new technologies and software cannot resolve all the challenges faced by small-scale farmers. Some of the existing challenges in agriculture are a product of post-Apartheid era policies which perpetuated dual farming systems. Thus, there are large-scale farms, also called commercial farms on one hand and small-scale farmers on the other. They mostly produce the same products, however, the problem is the size and quantity of the products, as the small-scale farmers' products tend to suffer compared to the produce of the large-scale farmers. (Berdegue & Fuentealba, 2011). Because of their unequal access to farming resources and the diverse challenges they experience during farming seasons their productivity rates are different (*ibid*). Small-scale farmers usually participate in agricultural activities which are fully or predominantly operated by family members in terms of maintenance, ownership and labour (Nagayets, 2005). Moreover, small-scale farmers are categorised as farmers that own two hectares of land or less. Against this emphasis on size, (*ibid*) argue that the categorisation of farms should also consider the existence of farm labour arrangement, efficiency and productivity.

## **1.2. RATIONALE OF THE STUDY**

There are about 40 000 commercial farm entities that contribute up to 95% of agricultural output in South Africa. On the other hand, about two million small-scale farmers produce the remaining 5% of farming output in the country (World Wildlife Fund (WWF, 2005). Lately, in South Africa, there are approximately 32,000 commercial farmers; of which between 5,00 and 7000 produce 80% of the agricultural output (International Trade Administration, 2021). Certainly, agriculture is an important economic originator in many developing countries, even though it is under pressure. It is a source of economic growth and a potential source of investment/opportunities for both the private and public sectors. In agriculture-based economies, which include most of the Sub-Saharan African countries, agriculture generates 80% of the gross domestic product (GDP) on average (FAO, 2015). About 94% of rural households rely on agricultural activities in agricultural-based countries, including South Africa (FAO, 2015). Countries that have recently experienced transformation, where agriculture is no longer a major source of economic growth are mostly from South and East Asia, the Middle East and North Africa. In these countries, the contribution of agriculture to the GDP is much lower because of agricultural challenges (Mahul & Stutle, 2010:19).

Over the years, there have been funds circulating and distributed by different organisations to support farmers in South Africa. There is a R1 billion-rand fund set up to help small-scale black farmers become commercial farmers in the agricultural sector (Prinsloo, 2022). In South Africa, the Department of Agriculture will grant this financial support to small-scale farmers, and this process will be assessed by the Industrial Development Corporation (IDC), which is a state-owned development bank (Prinsloo, 2021). These funds will also be in the form of loans that will have a tenure of 10 years.

According to the land reform minister, "It's is clear what we have in large measure are individuals who may not have requisite skills to undertake agricultural activities" (Makinana, 2021). Public employers do not have suitable skills to deal with land administration issues and this obstructs the government's land reform programme. From the minister's statement, it is clear that government is aware of the challenges facing the agricultural departments such as land administration and land governance systems particularly in areas of Mpumalanga and North West.

Even though farmers have been continuously contributing to the GDP, in most of the African countries there are multifaceted funding challenges negatively affecting output in agricultural sectors. For example, Mahul & Stutle in 2010 page 19 cites government financial constraints/ barriers as some of the challenges (Mahul & Stutle, 2010:19). Additionally, threats to agricultural output growth such as natural disasters, high temperatures and diseases affect farmers' contribution to economic growth. According to the Department of Agriculture, Forestry and Fisheries (DAFF), these risks have discouraged some investors from investing in the agricultural sector (DAFF, 2012). This has negatively affected livelihoods, as many people in remote areas depend on the growth of the sector for sustenance and income to maintain their livelihood, agriculture is a source of food, income and jobs (DAFF, 2012). Technology is an engine of growth in agriculture-based economies. Ever since the 1<sup>st</sup>, 2<sup>nd</sup> and 3<sup>rd</sup> revolutions were introduced and practised, developing countries have effectively reduced poverty and transformed backwards economies through technology (Mahul & Stutle, 2010:19).

The great quantities in the Western Cape and the Langkloof Valley of the Eastern Cape. Western Cape and Langkloof Valley produce greater agricultural output while, smaller production areas are found in Free State, Mpumalanga and Gauteng (DAFF, 2012). South Africa produced 1 644 825 tons of deciduous fruit. This included pineapples, grown mainly in the Eastern Cape and northern KwaZulu-Natal. Other subtropical fruits such as avocados, mangoes, bananas, litchis, guavas, papayas and granadillas are also widely grown in South Africa. Moreover, South Africa is regarded as the eighth largest wine producer in the world, something which should boost the economy and create more job opportunities (ibid).

Even though SA produces large volumes of food, there is still a need for more land in order to increase agricultural output. The Communal Land Rights Act 11 of 2004 (CLARA) which aligns with section 25(6) of the 1996 South African Constitution, was enacted to enhance the security of tenure to communities living on communal land. This was enacted against the background of serious community-level land challenges

among small-scale farmers. The significance of retrieving land resources, food security, securing land rights, and improving the livelihood of small-scale farmers have been a greater discourse (Odeny, 2013). There are unresolved social relations and existing issues on land settlement and ownership in South Africa and these have aggravated gender inequalities and domestic violence in some communities. Also, the cultural patriarchal patterns of land distribution in terms of access and ownership of land is evident in many communal areas (Walker, 2005). The continuation of gender inequality and the failure to strengthen women's land rights, in addition to poor access to financial resources, have reduced female small-scale farmers' contribution to economic growth. Thus, there is also a gender-related facet to the small-scale farming and productivity challenges in South Africa.

### **1.3. BACKGROUND OF THE STUDY**

Even though there are agricultural government policies in South Africa (Vink & Van Rooyen, 2009), they are biased and in favour of commercial farmers, and this has contributed to inequality in the access to funding from the land bank. Small-scale farmers struggle to attract full attention from the government when it comes to funding. This has been a great downfall in the effectiveness of the South African land reform programmes (Umhlaba Rural Services, 2006). Land reform programmes are strategies devised by the government to eliminate inequality and enhance the productivity of small-scale and emerging farmers (Odeny, 2013). Umhlaba Rural Services (2006), reveals that the state has sponsored many programmes to support farmers, mainly through infrastructure development and improvement in access to land and credit facilities for farmers, yet there are still persisting issues on land reform. While this is laudable, some small-scale farmers do not have access to working facilities/ proper farming tools. This is a great concern and a major problem in the agricultural sector worldwide. In South Africa, even though there are some programmes implemented and institutional entities created in attempts to resolve this, they have not fully resolved the agricultural challenges. These programmes and entities include the:

- a) Land Redistribution for Agricultural Development (LRAD)
- b) Micro-Agricultural Financial Institution of South Africa (MAFISA)
- c) Comprehensive Agricultural Support Programme (CASP)
- d) Industrial Development Corporation (IDC)

- e) Lima, Small Enterprise Development Agency SEDA
- f) Eastern Cape Development Corporation (ECDC)

Sikwela and Mushunje (2013) opine that the above-stated government initiatives have not fully become successfully operational as envisaged due to many institutional obstacles. As a result, problems such as limited access to technical skills and information, financing and challenges relating to high marketing and transaction costs in agricultural sectors still exist, especially among small-scale farmers who continue to be unproductive.

The study details the occurrences of the above-mentioned challenges while emphasising the need to implement the new 4IR technologies in agriculture. It is hoped that this will help in highlighting their potential use in managing agricultural threats and changes in facilitating progressive small-scale agricultural development in Kwadlangezwa of the KwaZulu-Natal (KZN) province in South Africa. Even though small-scale farmers are perceived as people who are not capable of producing large outputs but only small quantities, one may not repudiate that they are also entrepreneurs who are an important part of economic growth and who often experience the same challenges as commercial farmers. For these reasons, 4IR implications for small-scale farmers are explored and discussed with reference to the current challenges that small-scale farmers face.

## **1.4. THEORIES UNDERPINNING THE STUDY**

### **1.4.1. Classical /Political Economics (Sen 1985)**

The role of theories is to demonstrate phenomena in people's lives. Some theories are more relatable to, while some seem to be disconnected from, life events. For example, looking at the classical theory, which is one of the theories used in this study, there are both positive and negative sides to it. Sen (1985) was one of the well-known economists who contributed enormously to its development internationally. The classical theory is more focused on the organisation rather than the individual. A lot has been said about the role played by small-scale farmers, as they continue to improve agricultural services and contribute to the GDP and food security.

One may argue that they play a huge role in economic development and stabilising the import and export market. Some challenges have been negatively affecting their daily activities and contributing to lesser agricultural output. From the existing literature, scholars understand the work done by small-scale farmers in the marketplace, and in eliminating poverty and creating employment (Sen,1985).

On the other hand, with the implementation of the 4IR, machines could contribute to small-scale farmers' transformation into commercial farmers in the near future, even though the transformation brought about by the 4IR could contribute to farmers' reluctance to embrace instant change and adopt new technology. At some point, the capability and flexibility of small-scale farmers will be questioned at some stage of technological advancement. In addition, small-scale farmers may have preferences for old ways of farming for their own reasons, such as a lack of funding to purchase new tools. Due to the change of the times and the growing population, there is a need for the advancement of technology to increase output (Sen, 1985;18-20).

The capability theory questions helped the study to explore whether small-scale farmers will be able to integrate 4IR into their farming regimes. According to DAFF (2012), as of 31 January, there were 54 461 registered cooperatives in South Africa, which proves that there is progress, development and support for small-scale farmers. Conversely, small-scale farmers are challenged, producing lesser and failing to sell their output in bulk like commercial farmers. Even though the South African government has been trying to redress the challenges faced by small-scale farmers by publicising incentive schemes aimed at encouraging and establishing secondary marketing cooperatives, the problem is that the incentives are not limited to small-scale farmers; also, remote farmers are not aware of such financial support. The secondary marketing cooperatives' mandate is to reduce marketing transactional costs and allow small-scale farmers to have solid and trustworthy relationship with retailers (DAFF, 2012). According to Kurz (2019), the main thinkers of the classical political economy are Adam Smith (1776), Jean-Baptiste Say, David Ricardo, Thomas Robert Malthus, and John Stuart Mill. Their thoughts became central to the political economy in the late 18th and early-to-mid 19th century, primarily in Britain. The classical/political economics theory serves to unpack the essentiality of market economies to benefit the citizens.

Adanacioglu & Adanacioglu (2016) emphasise the importance of maximising exports and minimising imports in moving towards the accumulation of a country's economic stability. It has been proven by economists that market forces can improve the GDP of a country. Conversely, classical political economists classified the 'peasantries as farmers that do not make much output as a result of low or non-existing income/assets and holdings' (Lenin, 1974 a). Free trade in the global market has been able to accomplish higher productivity and increased goods and services at an affordable price for customers. In that manner, the developing and developed countries' financial prudence were part of this big drive, yet small-scale farmers were not well briefed on how they will benefit from free trade in the long run (Singh 1996 & Singer 1997). Additionally, even though the South African government intends to use different frameworks in improving market access for South African products to protect local agricultural industries against unfair trade practices, the objectives of this have not been met.

A free-market economy is based on securing property, capital growth, broadening markets and having a maintainable division of labour among society, which is one of the main purposes of the classical theory. Previously, the agriculture sectors were believed to be the chief factor of economic health, however, it has been affected by numerous challenges and the advancement of industries. As a result, the importance of labour productivity has been replaced by automation (Smith, 1776). In his book, *Wealth of Nations*, (*ibid*) he argues that everyone will benefit from the exclusion of tariffs and other barriers to trade markets, which the 4IR implications ought to be, without job loss. The growing population intensifies the supply and demand chain and, as a result, a small-scale farmer may or may not benefit from producing more food with the support of 4IR technologies/machines. Moreover, the 4IR will lead to a new technique of employment opportunities for the workforce in agricultural sectors and the small-scale farmers will benefit from Agri-Tech and contribute more to the GDP if they adopt the transformation.

#### **1.4.2. Capability approach theory (Sen 1980s)**

Amongst scholars, there has been an enormous debate about the breadth of technological improvement from each industrial revolution and the impact they had on society (Crafts 1985; Crafts and Harley 1992, 2000). If there were an accurate understanding of the needs of these types of farmers, then the 4IR technologies would be utilised based on the farmers' needs and abilities. Hence, this study explores whether the implementation of the 4IR technologies will benefit small-scale farmers. The capability approach theory will determine whether there is adequate literature on small-scale farmers benefiting from the agricultural technologies. From there, the theory will outline and provide solid informative data on whether small-scale farmers could adopt or learn from the agricultural technologies to be implemented in future.

Clark (2002) asserts that Amartya Sen's capability approach theory was established in 1985 and it has appeared to be the leading alternative to standard economic frameworks for understanding poverty, inequality and human development in society. According to Jones, Aguirre, and Calderone, (2004) the opinion and reactions of people should not be expected to be common as their experiences are not the same. For that reason, no change or programme goes according to plan and not every technology innovation (4IR) will work the same way amongst small-scale farmers (*one size does not fit all*). A lot of small-scale farmers are rural dwellers who are more receptive to change based on their capability and agricultural provisions. Thus, a change to the use of robots instead of human labour as part of the agricultural sector would be attainable by realising their ability and capability to purchase and utilise agricultural technologies. Sen (1985) found that the basic idea of life is to develop policies that focus on the opportunities for improving one's (small-scale farmers) rather than the country's economic outcomes. Hence, 'being able' necessitates both freedoms from external restraints and personal skills for workers. People are better off when they do what makes them happy. In this regard, small-scale farmers have persevered and survived in the agricultural sector regardless of the challenges they face daily. In this context, small-scale farmers may feel reluctant to embrace the 4IR

transformation project due to their affinity for physical or hard labour because they are attached to old ways and fewer technological machines.

With so much at hand, small-scale farmers are willingly participating and able to produce agricultural output based on their capabilities. Therefore, the capability theory proves that even though small-scale farmers struggle and face many challenges, they are capable of providing jobs and contributing to the agricultural sector in SA. According to Ferreira (1993: 55), agriculture sectors have remained the means of survival for black people, a dominant source of employment for black South Africans, and one of the major originators of economic growth in developing countries like South Africa. Furthermore, Sen (1985) emphasises the importance of acknowledging people's effort when considering that economic growth and expansion of goods and services are necessary during the process of human development. According to Sen (1985, 25-26; 1999, 70-71), it is important to consider the wellness of people to function in the workplace, which indicates their capabilities to effectively function and provide better service delivery.

Mukindia (2014) argues that small-scale farmers thrive when they participate in the ever-changing environment or the global economy. As a result, it is essential to create an entrepreneurial culture in rural communities. This is part of development, which the capability theory has failed to point out. Moreover, the capability theory missed out on the fact that in remote rural areas, markets may fail because of "small" markets and small surroundings and, as a result, the small-scale farmers may end up being challenged by the high costs of participating. This also includes social or economic barriers to small-scale participation. Burress and Cook (2007) supported the idea that entrepreneurship is frequently a collective performance rather than a sole endeavour among farmers. In support of the capability theory by Sen (1985) the main concern of this theory is to grant people opportunities to develop their agricultural activities. Lastly, investment in human capital acts as an obstacle to the effectiveness of extension programmes and technological change /revolution. The improved inputs in agriculture have been used in the coastal region where the large holdings are concerted and already benefiting from technological machines (1,2,3 and 4IR) and policies. On the other hand, the demand for agricultural machinery and tractors is also concentrated in the coastal region, which raises the question of where this puts black small-scale

farmers in future. Moreover, if small-scale farmers struggled to leap-frog from the previous revolutions, what will be the implication of the 4IR technologies for small-scale farmers' development in KwaDlangezwa, KZN in South Africa?

## **1.5. STATEMENT OF PROBLEM**

The government defined the main agricultural policy objectives in the context of the broad economic reforms in South Africa (*White Paper on Agriculture*,1995). The following were the main policy objectives:

- To build an efficient and internationally competitive agricultural sector.
- To contribute to the objectives of the Growth, Employment and Redistribution (GEAR) strategy, aimed at the achievement of economic growth by reduction of income inequalities and elimination of poverty.
- To support the emergence of small and medium-sized farms side by side with large-scale commercial farms.
- To preserve agricultural natural resources and to develop supporting policies and institutions (Strategic Plan for South African Agriculture, 2001).

After 1994, the South African government implemented a land reform programme for the improvement and transformation of the agricultural sector, which includes both commercials and small-scale farmers' development (Department of Agriculture, 2004). Furthermore, its main purpose was to achieve agrarian reform and also to provide training opportunities for farmers in order to improve their performance and competence. The opportunity has presented itself (4IR); small-scale farmers can fully participate by using technology and creating more produce to meet the needs of the growing population, especially considering that the world population is estimated to be 9.8 billion in 2050 (Food and Agricultural Organization of the United Nations,2011a).

Despite the promising future offered by the new technologies, small-scale farmers in South Africa are afflicted by various social ills such as poverty, hunger and poor remuneration (Mudhara, 2010). Within the context of 4IR, some scholars have concluded that agricultural digitalisation and automation will certainly reinforce social, economic, and racial inequities (Bronson & Knezevic,2016a, 2016b).

Advanced labour and skills development in rural areas have been enhanced by digital technologies that are already reflected among societies (Basu & Chakraborty, 2011). The use of agricultural tools such as (Gebbers & Adamchuk, 2010) GPS, sensors and data modelling software along with automated technologies like smart tractors, drones and robots will assist farmers to be more precise with inputs and quality output. The input of such as seeds, water, fertilizers and pesticides will be enhanced as a result of the knowledge passed on by agroecological conditions to farmers, including small-scale. However, small-scale farmers lack vital technological farming skills and knowledge on landscape interactions (NEPAD, 2013).

In addition to the farmers lacking such skills, in many farming places the soil has been degraded and has become infertile, which destroys the health of the crops and seeds. From the existing literature on the different revolutions, researchers, policymakers, and commentators are all positive about the amalgamation of these technologies (4IR) to increase profits and output. Yet, they are not specific on how small-scale farmers will partake in the 4IR technologies without being left behind as they were with the other revolutions. The production prospects of small-scale farmers are also disrupted by deficient access to sufficient land, technologies, instruments and other agricultural resources, and the scarcity of water supply (Malan, 2018). However, Larson, Otsuka, Matsumoto, and Kilic, (2014) assert that greater means of agricultural efficiency and development for African small-scale farmers are influenced by adopting agricultural technologies to improve farming yields and produce quality output and also healthy food (food security). At present, the total output from small-scale farmers is not sufficient or satisfactory and, as a result, this impacts on the greater potential output, because of insufficient agricultural technologies and also inhibit exports (DAFF, 2012).

Over the past year's small-scale farmers have experienced challenges restricting the expansion of agricultural output. There are inadequate working materials such as tractors, but also limited crops, only occasional transportation, lack of marketing, advertising channels and supply chains. Moreover, small-scale the plight of farmers is not limited to deficiencies in harvesting skills and storage of their final produce. One may argue that not all farmers will be able to purchase agricultural technologies (4IR), more especially small-scale farmers who can barely afford to hire or rent tractors (Zilberman, Khanna, and Lipper, 1997). There is also apprehension about the use of

fancy robots and other technological innovations possibly replacing human labour and thereby increasing the unemployment rate in the agricultural sectors (*ibid*).

The implementation of farming techniques to grow different crops requires a broad marketing value chain involving small-scale farmers being well equipped with agricultural technologies (Mbatha,2018). Therefore, the use of the 4IR should not be influenced by foreign practices only, but by the needs of (small-scale) farmers in South Africa (Hofmann & Rüsch, 2017); DFKI (2011). The study revealed unforeseen threats to small-scale farmers which were overlooked by the 4IR and Agri-Tech. Hence, the 4IR should not be chaotically adopted with no right procedures applied. It should also be vigilantly approved because it might negatively impact social connections by aggravating unemployment and other related factors such as high crime, and malnutrition. The 4IR and agricultural policies will not serve their main purpose if the government fails to reconcile the needs of commercial and small-scale farmers equally when implementing agricultural policies.

## **1.6. AIMS OF THE STUDY**

The aim of the study was to find the implications of the 4IR on small-scale farmers in KwaDlangezwa, KwaZulu Natal in South Africa. The main focus was on how the technological transformation influences the agriculture stability of small-scale farmers and enhance agricultural outputs. With so much innovation from different revolutions technology in agricultural sectors has its pros and cons. In that regard, the study aimed at exploring the 4IR technological agricultural machines (robots, drones and driverless tractors) aimed at improving small-scale farmers' agricultural activities before resolving immediate challenges such as financial constraints and the land issue. Moreover, the aim was to explore how the 4IR will influence the export and import of agricultural output, making sure that both commercial and small-scale farmers benefit from this Agri-Tech advancement. The harnessing of the 4IR technologies in agriculture has been perceived as an innovative way of improving the quality of the agricultural product, also allowing small-scale farmers to engage and practise agricultural technological systems. It is essential to note that the 4IR is a continuation of the three previous well-known revolutions, just that this time around these technologies are more advanced and introduce new concepts such as innovative robots. The relationship between

humans and robots is growing in different industries, and the agricultural sector is part of that output improvement/development.

## **1.7. RESEARCH OBJECTIVES**

The objectives of the study were:

- To assess the perceptions of small-scale farmers concerning the implications of the Fourth Industrial Revolution, and its benefits to their output.
- To determine the challenges faced by small-scale farmers while reflecting on the factors contributing to their experiences.
- To ascertain the extent of government and stakeholder financial support in small-scale farming.
- To evaluate whether the 4IR characteristics parts will alleviate the agricultural output and organisational tasks in the KwaDlangezwa area.
- To examine the extent of technology Agri-tech knowledge and skills possessed by farmers in KwaDlangezwa.
- To suggest any innovative policy frameworks and recommendations for small-scale farmers' agricultural sustainability.

## **1.8. RESEARCH QUESTIONS**

- Is the Fourth Industrial Revolution, going to benefit small-scale farming in KwaDlangezwa KwaZulu Natal in South African?
- Are there any challenges encountered by small-scale farmers and what are the contributing factors to their daily experiences?
- What are the implications of the Fourth Industrial Revolution, and government policies on small-scale farmers' development to greater output?
- To what extent does small scale farmers benefit from the government's fiscal support and other agricultural sectors stakeholders?
- How knowledgeable and skilful are farmers about Agri-tech and 4IR characteristics in the KwaDlangezwa area.

- Is there a need for new agricultural policies, specifically for small-scale farmers regarding the emerging 4IR; in order to successfully develop agriculture in KwaDlangezwa?

## **1.9. RESEARCH METHODOLOGY / RESEARCH DESIGN**

Research methodology refers to the tools used as specific procedures or techniques to identify, select and process how the data for the study will be collected and analysed. These instruments used to gather the data should be selected wisely, including the research philosophy, research design, research method and data collection.

### **1.9.1. Research Philosophy**

The research philosophy carries the responsibility of being the guideline on how to collect and analyse data. The study used pragmatism research (Strand & Legg, 2019) which was originated in the 19<sup>th</sup> to early 20<sup>th</sup> by the United States of America (USA) in the works of Charles Pierce, William James and John Dewey. It is used as a concept that can only be relevant meant to support peoples' action (Kelemen & Rumens 2008). Furthermore, it strived to accommodate both objectivism and subjectivity, values and facts, and also the accuracy and rigour of the knowledge looking at different contextualised experiences. This is done during the process of considering theories, ideas, and concepts.

On the other hand, the emphasis of interpretivism is on exploring a social phenomenon to gain a complete understanding of individual experiences and, as a result, the interpretation of everyday events (Collis & Hussey, 2013). People's experiences are remarked analysed through social phenomena. In this study, the participant's views were drawn from their experiences and perceptions in order to answer the research questions.

### **1.9.2. Research Design**

Research design is a plan or strategy that measures the process regarding the arrangement of how the respondents should be asked questions while collecting information (Alford, 2011). Precisely, a small number represents a large population; it is important that their responses are accurate enough to answer the objectives/questions of the study. The study took on a qualitative and exploratory research design from a carefully selected and well-appointed participant. The qualitative research method comprises the process of data collection of documentary evidence, texts, sounds, and interviews (Bacon-Shone, 2015). The exploratory research design consists of the systematic collection, arrangement and analysis of data. Moreover, the qualitative data analysis procedure also focusses on describing the 'how' question with regard to the behaviour of people because of their different understandings of the study at hand, while the quantitative method deals with data specifically which includes quantified and measurable statistical techniques namely, the what, where, when, how many, and how much questions (*ibid*).

The study used the qualitative and exploratory research design to answer the research questions. Exploratory research is defined as research used to investigate a research problem that is not clearly defined at the beginning of the study. Therefore, for this particular study the qualitative and exploratory research design helped the researcher to gain more insights into how the 4IR will assist small-scale farmers and also into the 'what' question regarding the implications of the 4IR. In that way, the research developed a good background on the existence of previous revolutions and how they have impacted and changed the agricultural sectors as a whole, and on the agricultural sectors KwaDlangezwa, KwaZulu-Natal in particular. Furthermore, with that useful information to hand the study gained more insight into what has been brought by the 1st to 3rd revolutions and the involvement of government in agricultural sectors and whether it has loopholes or it is steady (Ofori, 2014:120). Therefore, the qualitative method was used to determine the level of engagement of technology in agricultural sectors and significant collaboration between technology and agriculture globally, nationally, provincially and locally. It also questioned the reality of existing challenges experienced by small-scale farmers and might assist the department of agriculture resolve issues affecting small-scale farmers directly. Even though the previous

revolutions have expanded the output in different business corporations, it is also wise to enhance the working tools utilised by small-scale farmers.

### **1.9.3. Research Method**

Research paradigms consist of qualitative and quantitative research (Gravette & Forzano, 2009). Qualitative research involves the collection of experiences from participants that are later changed to data in a normal setting to gain insights from certain phenomena. In contrast, quantitative research focuses on the objective measurement and the mathematical, statistical, and numerical analysis of data collected using polls, questionnaires, and surveys (Babbie, 2010). The study used qualitative data collection, to gain adequate information on the implications of the 4IR for small-scale farmers. Moreover, this contributed to the inadequate literature on small-scale farmers engaging in industrial revolutions and answered the how and who questions regarding who will actually benefit from the 4IR between commercial, small-scale, and even emerging farmers.

### **1.9.4. Data Collection Method**

Primary data was used to answer the questions raised by the study. The study used unstructured interviews to answer the open-ended questions. In this study, appointments were arranged for interviews in the department of agriculture, and with lecturers from the University of Zululand, a traditional leader, community members in KwaDlangezwa, students and lecturers at Owen Sithole College of Agriculture, small-scale and commercial farmers in KwaDlangezwa and other participants who are not active in farming. Also, farmers and employees were interviewed while they were working in their fields in order to have visuals of their hectors. The study used secondary data which included relevant books, articles/journals, published theses, magazine publications, research projects, newspapers, relevant documents, papers, documentary records, reports and the Internet. Even though the study was using primary data, it was essential to include secondary data during research to lay a concrete foundation and eliminate the chances of the researcher repeating the published work. In that case, the secondary data helped validate the primary data statements from the participants during interviews. Participants' involvement was voluntary and thus, they were able to withdraw at any time.

### **1.9.5. Population of Interest**

Population in research is a comprehensive group of individuals, with common characteristics that are in the interest of a particular piece of study (Van den Broeck, Sandoy and Brestoff, 2013). As a result, in this case, the researcher recruited the sample selected from the population aligning their experiences with their age, ethnicity, socio-economic status, educational level, marital status and work status. The study sought to reveal and unpack the 4IR implications for agriculture and also to explore how the advancement of technology will benefit small-scale farmers, community and agricultural employees, for example in terms of potential employment and affordable and easily accessible products. KwaDlangezwa falls under the King Cetshwayo District Municipality, which is located in KwaZulu Natal, South Africa and has a population of 894260 habitants. There are two types of crop farming, namely vegetables and sugarcane, and livestock farming such as goats, cows and chickens. Hence, the study focussed on the above types of farming in order to get more information from small-scale farmers on how technology has enhanced and will continue to enhance their coping techniques for greater output.

Even though small-scale farmers participate in crop farming, lately most males have shown a preference for producing sugarcane and for vegetables are produced for home consumption. The small-scale farmers at KwaDlangezwa take their sugarcane to Felixton Mill 9,8 km to Dlangezwa which is situated on the northern KwaZulu-Natal coast, 160km near the town of Mpangeni. In that manner in light of that data was collected from the following categories of people: community members of KwaDlangezwa, farmers (both commercial and small-scale), lecturers and students at the University of Zululand and Owen Sithole College of Agriculture, the Department of Agriculture at Empangeni and Richards Bay in Kwazulu-Natal, and traditional leaders Inkosi Mthethwa and Induna. Data was also collected from the University of Johannesburg (as they specialise in technology and agricultural tools), the Agricultural Research Council, and the manager at Felixton Mill.

### **1.9.6 Sampling method**

It is important to note that sampling is used as a tool to collect information from a subset of a population (community) to validate the study/research. In research the term

“sample” refers to a group of people, objects, or items that are taken from a larger population for participating purposes (Daniel, 2012) such as the collection of data. For a researcher to have a valid conclusion from her/his results, it is essential that the selected sample is representative of the population, yet in a smaller group. There are two types of sampling methods, namely, probability sampling and non-probability sampling. Probability sampling randomly selects participants, which allows the researcher to make statistical inferences about the whole group; while non-probability sampling, carried through non-random selection. This study used non-probability sampling to reach more farmers and relevant/suitable participants. Most importantly, the study also used the purposive sampling technique.

This provided more information from the participants who were representative of the chosen sample. The study, therefore, used the purposive sampling method, which falls under the non-probability sampling method to collect data. As for Creswell, Plano Clark 2(011) the purposive sampling is also known as judgemental sampling, during the selection of the sample; the researcher deliberately chooses participants based on their relatedness to the topic and study at hand Dolisca, McDaniel & Teeter (2007). In other words, the researcher knows where to go and contact the specific target people for interviews. For this reason, purposive sampling guided this study to select the appropriate research participants previously mentioned.

All these different participants gave particular information based on their experiences with technology and they shared their views on whether there is a need to adopt to the 4IR for greater quality and increased output and to improve their working tools. The selected targeted participants were more knowledgeable about the agricultural issues/challenges and also the role of technology in enhancing and developing agriculture. These participants have been in the agricultural business for many years, some of them since they were young, while on the other hand, some are philosophisers of farming /agriculture. The researcher was able to ascertain the gap and differences to find more realistic information on the necessity of the 4IR in small-scale farmers' development (Bacon-Shone, 2015). Interviewing the entire population would have been impossible, hence it was important to use the sample instead of the whole population to collect primary data. As a result, Felixton Mill confirmed that there were 3400 small-scale farmers bringing sugarcane to their company in 2020. With this

information, it was easy to contact commercial farmers and make appointments to provide more details about the study.

The number of small-scale farmers shows that sugarcane growers have reliable marketing, unlike vegetable and livestock farmers who are not easily traced in this area (KwaDlangezwa). The study focussed on the cane growers, vegetable and livestock farmers while assessing the 4IR implications for increasing the agricultural output. Moreover, using non-probability sampling contributed to the research objectives, because the participants selected provided accurate information and answered the study's questions and objectives (De Vaus, 2002; Burns and Grove, 2007). The study interviewed 28 participants selected through purposive sampling.

### **1.9.7. Research Instrument**

The study used semi-structured interviews to enable the researcher to cover all the study questions and to obtain feasible answers from the participants. The semi-structured interview leads to in-depth probing and allows the interviewer to add more familiarity to the context of the study (Berg, 2007:39). Therefore, the study found it imperative to use the one-on-one interview technique. During interviews, the researcher used open-ended questions to gather further information which the researcher might not have originally included, but which proved vital to the findings of the study and thus, contributed robust findings to the existing body of knowledge. The experience and knowledge of the chosen participants were handy for the study findings' solidity. The interviews were conducted in English and isiZulu, depending on the participant's language preference. Each participant was interviewed for approximately 35 minutes including the recording and drafting of answers. The interview schedule consisted of sections A and B. Section A focussed on gender, age, race and level of education, and section B contained the open-ended interviews questions. (See Annexure A).

### **1.9.8. Data Analysis and interpretation**

Data analysis and interpretation help the researcher to easily arrange the findings of the study after data have been collected (Babbie & Mouton, 2009; Scott & Usher,

2011 ). According to Fereday & Muir-Cochrane (2006), the qualitative data analysis method identifies, analyses and reports patterns that are later converted to themes during data analysis (Braun & Clarke, 2006:77-101).The study will use discourse data analyses because it more suitable for the study.

## **1.10. LIMITATIONS OF THE STUDY**

South Africa has nine provinces, which are all dependent on agricultural activities and output. While the study focus was mainly on the Mpangeni(Dlangezwa) area, including other farmers from different places would probably have enhanced the reliability of the research. The small-scale farmers at KwaDlangezwa may share similar characteristics with other farmers from other provinces but that does not mean the participants have the same experience on the use and ownership of the technology. Some small-scale farmers are more knowledgeable on how to use the technology; others have no clue; especially the ones that are illiterate. As a result, not all small-scale farmers have a good understanding of the technologies brought by the 4IR, which would have led to inadequate information /data to achieve the main purpose of the study.

## **1.11. OVERVIEW OF CHAPTERS**

The study consists of the following chapters:

### **Chapter one: Introduction**

Like any other research, this this chapter must represent all the research elements as underpinning tools of the entire research such as the introduction/background of the study, statement of the problem, the significance of the study, research objectives/questions, and research methodology.

### **Chapters two and three: Theoretical Framework and Literature Review**

There are two sections under one chapter The first section contains the evaluation of the farming legislative framework and its role in the activities of commercial and small-scale farmers. There are agricultural policies that have been helpful and beneficial for both commercial and small-scale farmers. It was also considered important under this section to revisit the agricultural policies and assess their role in developing commercial and small-scale farmers, in developed and developing countries.

Moreover, the same policies were used, along with the theoretical framework, with the purpose of harnessing the 4IR components parts and agriculture in KwaDlangezwa in KwaZulu Natal, South Africa. Policies and the legislation were not adequate to answer the research questions, so the second section mainly focussed on the literature review on the role of agriculture, and the challenges, opportunities, threats, strengths and weaknesses.

In that manner, there was a reflective examination/review of the relevant and available literature under this study. The empirical literature on the 4IR technologies was also be taken from the existing literature. There were verified tools to obtain the appropriate agricultural literature, such as: using the internet, un/published articles and journals, books, and newspapers for relevant and informative information on agricultural sectors. After so much reviewing, the study had already gathered sufficient information at the international, national and local levels to create an understanding of intuition in South African agriculture, and its relatedness to previous technologies and the future technology (4IR) in agriculture. Determining whether agricultural sectors are ready for the massive shift brought about by the 4IR after the two sections strengthened the hypothesis of the study.

#### **Chapter four: Research Methodology**

The research methodology is a framework, preparing and controlling by making sure that the correct tools are utilised. The main purpose of this chapter was to identify research methods suitable for the study, such as research design, research population, sampling methods, data collection method, and data analysis to produce reliable/relevant findings.

#### **Chapter five: Data collection, Data analysis and data interpretation**

After a long journey, from crafting of the proposal and other chapters interconnected to each other; this chapter is the heart and mind of the study that have been keeping this study stable and alive. Therefore, the aim was to move away as far as possible from secondary data and allow primary data to answer the research questions. Interviews were conducted to collect data and analyse the same data with no additional

information apart from that presented by the participants. The data collection goes hand in hand with the interpretation/analysing data, which leads to the next chapter, which is the summary, conclusion and recommendations to consolidate the study.

### **Chapter Six: Summary, Conclusion and Recommendations**

This, the last chapter of the study, consists of the summary, conclusion and recommendations which are essential to fully validate the study findings. In that manner the hypothetical ideology, in this stage the findings of the research successfully produced the recommendations of the study. In this last chapter, the novelty of the study contributed to resolve unforeseen and present agricultural issues/challenges not only in the KwaDlangezwa area but also in other regions. For an instance, even assist small-scale farmers to adopt or even expand their contextual advanced farming tools at an affordable price and while producing more output also collaborating their business to produce massively.

### **CHAPTER SUMMARY**

This first chapter discussed the following: an introduction to and an overview of the study; the rationale of the study; the background to the study; theories underpinning the study; the objectives of the study; key research questions for the study; the limitations of the study; and an overview of the chapters. The next chapter presents agricultural legislation in South Africa and a literature review on small-scale farmers challenges they face and explores the use of 4IR implications for developing and the importance of adopting technological agricultural tools in KwaDlangezwa, KwaZulu Natal, South Africa in order to sustain agriculture.

## **CHAPTER TWO**

### **AGRICULTURAL LEGISLATION IN SOUTH AFRICA**

#### **2.1. Introduction**

Some of the agricultural policies have brought fundamental issues into agriculture as a sector, particularly in developing countries. As noted by Mayende (2002), in developing countries the agriculture is less technologically advanced and modernised. As a result, farmers struggle to transform agriculture from traditional labour-based agriculture to technology-based agriculture, especially small-scale farmers. In low-income countries the majority of farmers have not accessed basic technologies, which is both a reason for and a consequence of low incomes and skewed land policies (Barrett, Carter & Timmer 2010). Consequently, modernisation in businesses and technological change has been regarded as the driving force behind economic growth, not merely to develop people's lives and create more opportunities for poor people.

Respectively, in each and every developing country the agriculture purpose was already set to carry out its three fundamental roles in an era of industrialisation, namely; to increase production and productivity in order to feed the growing non-agricultural population; to prepare a large and increasing surplus of potential workers for the towns and industries; lastly, to provide a mechanism for the increase of capital to be used in the more modern sectors of the economy (Hobsbawm, 1996). In South Africa, the agricultural policies were well established after 1994, and they were developed to fully support commercial and small-scale farmers (Senyolo, 2007). Moreover, from the existing policies, there are government institutions like the Department of Agriculture, the Land Bank and the Agricultural Research Council that implement policies to cater for the needs of commercial and small-scale farmers with their agricultural daily activities.

South Africa's approach to agriculture and rural development focuses on the concept of developing local government and the economy. The institutional framework has been constantly if not slowly, progressing while also creating opportunities for communities to participate in the movement. In support of this statement, Sen (1980) emphasises in terms of the Capability Approach theory that development should not only focus on economic growth but also support individual development. According to the Africa Research Institute (2013), in South Africa the security of tenure is legally established for many rural residents and, as a result, they are not benefiting from the rural developments, which make most of the programmes to be non-benefiting for the poor people. The legislation intended to advance the rights of tenure, for instance, the Extension of Security of Tenure Act (Act No 62 of 1997; Republic of South Africa (1997), has received criticism regarding its ineffectiveness over the past years. One may argue that one of the reasons it failed was because it was poorly enforced.

According to Halle (2001) the idea of implementing green economy projects, and also introducing new agricultural activities, necessitates some long-term investments, and not just investments that are risky. Moreover, they have to be suitable for small-scale farmers because they can often only afford to adopt short-term survival strategies based on their output and turnover. Even though small and medium-scale farmers have been able to produce agricultural output, it is not sufficient to open more doors when it comes to competing internationally (Taljaard, 2007).

The inappropriately designed and implemented policies on modernisation have brought unfavourable effects to poor people. As a result, the policy alterations have affected small-scale farmers output in many developing countries (Renkow and Byerlee, 2010). The same changes introduced free trade which has resulted in price fluctuations and also brought about a whole new dimension of risk for commercial and small-scale farmers (Taljaard, 2007). In the 1960s and 1970s, African countries were sceptical about the virtues of free trade but since the late 1980s, they have shown great interest in multilateral trade, along with agricultural negotiations (Economic Commission for Africa (ECA), 2004) because they saw how the policy worked for developed countries in that particular era. The reinvigoration of the agricultural sector empowered South Africa to participate among the world's leading exporters of agro-food products such as fresh fruit, wine,

and sugar. Moreover, the country is also a central trader in the African region. In the 20<sup>th</sup> century, agriculturalists witnessed substantial agricultural export-oriented growth, and commercial farmers produced more compared to small-scale farmers. This resulted in South Africa's agricultural export revenues reaching almost 9% of the total value of national exports (OECD, 2006). However, Coetzee (2008) asserted that the current export trend shows that the capacity has been declining, whereas imports are growing enormously, meaning there is a strain on SA natural resources. Agricultural crises have contributed to South Africa becoming a net importer of major food items, with the additional effect of worsening the existence of small-scale farmers and their passion to strive for more, while being isolated (FAO, 2012)

## **2.2. SOUTH AFRICAN LEGISLATION**

According to Mudhara (2010), the essentiality of market intervention schemes provided support exclusively for commercial farms. The Marketing Act was one of the most controversial pieces of economic legislation in South African agriculture. This act was promulgated in 1937 (Act 27 of 1937) and amended in 1968. In 1997 the Marketing Act was repealed following the endorsement of the Marketing of Agricultural Products Act, Act 47 of 1996. The new Act involves less state interference, regulation and state involvement in agricultural marketing and product prices.

The Marketing of Agricultural Products Act of 1996 was introduced by the South African government to liberalise the field of marketing (Mudhara; 2010). According to Satgar (2011), the liberalisation of the markets was meant to create equal opportunities for all participants in the agricultural industry. As for Smith (1776) in classical/political theory, the involvement and participation of individuals are important to boost the economy. Liberalisation changed how farmers worked, separated them and created inequality between commercial and small-scale farmers. There are persisting challenges faced by farmers as barriers to increased agricultural output. From the use of technology most big and small cooperatives are greater than before in terms of structural power after markets were liberalised private and public sectors companies and making private more privileged compared to public. Satgar (2011) added that the liberalisation drive was to accommodate farmers in broader marketing for the dual

agricultural system, yet the same policies lacked the concept of accommodating small-scale farmers in order to fully participate in the agricultural sector. As a result, there are countless existing challenges brought about by the uncertainty of policies that were adopted by the South African government, which were initially perceived as a great tool, yet not realising the reality and also an inevitable failure in SA. Without policies, there is no agriculture, and without agriculture, the policies in existence will not serve any purpose in this huge sector. Given that, this chapter consists of two sections. It is imperative to firstly review the relevant legislation/policies that the South African government adopted which are related to the study. After these Acts have been identified, the second section will give more information on the revolutions that have taken place, and question the readiness of SA to embrace 4IR and support small-scale farmers, based on the agricultural literature presented and small-scale farmers (output).

## **2.3 THE POLICY UNCERTAINTY**

### **2.3.1. Challenges brought by agricultural policies in SA**

For Jonsson and Subramanian (2001) South Africa has embarked on several major economic reforms, with import liberalisation being a principal component. These reforms have brought complementary changes in industrial policy and technology. Over a period, many years now South African industries have become more efficient, also advancing in technology. Yet, there is still no consensus on the influence that trade liberalisation has on agricultural employment and the practice of technological change and factor market rigidities (Edwards and Golub, 2002). According to Bhorat and Hodge (1999) and Birdi, Dunne, & Watson, (2002) trade liberalisation destructively affected employment and, as a result, there has been poor productivity in small-scale sectors, because of the increasing use of agricultural machinery ( Fedderke, Henderson, Mariotti, & Vase,2003) . As for Edwards and Golub (2002) argue that international trade relationships mean that embracing new technological change makes the workforce more efficient and improves productivity in all sectors, which leads to better economic growth for developed and developing countries. Conversely, while the advancement of technology has been a great tool for commercial farmers, small-scale farmers have little knowledge on how to operate some of the agricultural technologies

let alone be capable of purchasing them. According to Sen (1980), human development is part of “being able” to cope or to do something or perform in a certain manner. Small-scale farmers may not be able to purchase expensive agricultural machines yet, but for years they have contributed to the Gross Domestic Product (GDP). According to Basok, (2002), since the 1940s, the ratio of family labour to wage labour has significantly declined due to increased urban employment and better opportunities, which involves, inter alia, machines replacing humans in different sectors. On the other, hand older farmers are not replaced by young and experienced farmers which imposed pressure on the commercialisation and consolidation of farming sectors. There has been the rising cost of farm inputs, also buyer-driven supply chains along with the liberalisation of trade in international markets which have resulted in many producers either abandoning the farming business or increasing the scale of their operation. Most farmers have invested in more land or farm implements to survive and continue to contribute to the agricultural sector (*ibid*). This has resulted in a local agricultural wage labour pool. North American agriculture has been marked by a growing demand for temporary migrant wage labour to sustain farmworkers, instead of permanent workers, a system now also being used by most countries including SA (Basok, 2002; Kandel, 2008).

Small-scale farmers in SA also experienced similar challenges from developing countries. As for, Wood (1995) asserts that, previously, most countries were competing against cheaper foreign imports, and organisations have been obliged to raise productivity through unskilled labour systems to prevent technical progress or defensive innovation that led to high employment. Pissarides (1997) argues that trade liberalisation also encouraged skill-based technological transfers by using foreign technology and by the importing of goods from developed countries, which contributed to developing countries depending mostly on imports. For De Haan, van Veen, Brandenburg, Gauthier, Le Gall, Merns and Simeon, (2001) stated that small-scale farmers all over the world are challenged by common crises. This is not limited to political and socio-economic challenges, such as coping with alterations to agricultural and rural policies and poverty. Moreover, they struggle with global food market dynamics while trying to sustain a bearable livelihood strategy, and biophysical challenges, namely, climatic variability, land degradation and disease outbreaks. These joint struggles are not place specific in their origins and there are not many

policies to eliminate the persisting agricultural issues (Cutter, Mitchell, and Scott 2000)

De Wilde, (2016) states that policies have not yet reached their full potential to emphasise the complexity of development and be alert to the fact that agriculture does not stand on its own. Also, technological developments do not take place autonomously; they always interact with developments in the economy, which aim at benefiting society and politics. As a result, the food systems from different countries are intertwined in numerous ways, starting from trade in raw materials up to the final products. Additionally, the empirical research suggests that technological transformation has concentrated the demand for labour, particularly for unskilled labour (Bhorat and Hodge, 1999; Edwards, 2001; Edwards, 2002 and Fedderke et al., 2003). Retailers or companies in the food chain have exercised considerable political and social influence, affecting consumer demand as they have a right to a quality product.

Anderson (2010) asserts that there is a decline in the costs of cross-border trade in farms and other products besides agricultural output. Conversely, tackling hunger crises cannot be addressed merely by increasing food production. According to the United Nations (2017) there has been a loophole and policy failure to address challenges faced by small-scale farmers such as; land and financial constraints up to well-functioning markets in KwaZulu-Natal, to increase incomes for smallholder farmers, and also to provide equal access to technology and land. Furthermore, investments in small-scale farmers are lacking even though they play a role in creating a vibrant and productive agricultural sector that builds food security.

The Food and Agriculture Organization of the United Nations (2015) points out that more than enough food is manufactured to feed everyone worldwide. Yet there is an estimation of close to 800 million people persistently experiencing hunger. This is influenced by the fact that the affordability of food mainly relates to income, and ensuring access to food has remained as one of the key pillars of food security and the wider anti-poverty agenda.

### **2.3.2. Legislation and policies on agriculture**

Among other existing issues, one of the greatest uncertainties facing South African agriculture at present relates to the policies that have been put into practice such as the land reform policies, and in particular, the one concerning expropriation without compensation. As Salie (2020) reported in the News 24 - City Press, land expropriation without compensation will benefit few, because of the state-controlled land policies. Even other political parties such as the Economic Freedom Fighters (EFF) joined together and tried to bring justice. Amongst other challenges, the skewed land reforms have failed to embrace the free market, which has been affecting small-scale farmers. One may argue that it is the general perception that the overall execution of strategies and programmes on land reform has been poor, resulting in various failures and black people continue to suffer. Consequently, land reform has failed and there is an increased fascination with the issue of land ownership, while the big question of what happens with the land once ownership is transferred is not adequately addressed. Even though small-scale farmers need land, more chaos and distraction is preventing them from fully utilising the land, such as financial constraints. Quite a lot of statistics have clearly identified the let-downs of delivery in the redistribution and restitution of land, the denial of land rights and tenure security issues.

Yet, policymakers ignore the effects of land reform on poor and rural-based people and farmers. Even though the agricultural programmes and policies have been implemented to support growth and food security, and which are well-executed and supported by strong institutions, there are inequalities that have been created in the past that have not been addressed yet. For decades, the government wanted and aimed at empowering black people, and developing their businesses by implementing a land reform support policy framework, which today is in question about whether it serves its purpose or is in fact worsening the situation for poor people (Norwegian Refugee Council Unsettled.2018)

Van Schalkwyk, Obi, & van Tilburg, (2012) also added that in South Africa, market liberalisation implementation was a major drawback for small-scale farmers as they are perceived as inexperienced farmers while at the same time they are expected to compete for market share in extremely competitive agricultural environmental sectors with less sophisticated equipment and hampered by financial constraints. Furthermore,

small-scale farmers experienced high transaction and transport costs to access markets after the liberalisation of the market which has laid them low. Smith (1776) emphasises that people as a nation should benefit from the trade market because it determines the increase of the economy of failure. According to the Department of Agriculture, Forestry and Fisheries (2012), small-scale farmers have been struggling to have reliable trustworthy markets to distribute their product which, one may argue, is a result of trade liberalisation that was initiated to benefit the white farmers based on their output and contribution to the economy.

The small-scale farmers have also experienced exclusion from the process of setting market prices, and this has affected their potential for exporting goods. The fact that the prices have been established by big supermarket operators making decisions for commercial and small-scale farmers creates a greater difference in profit based on what they produce as a final product. The downside of this is that the small-scale farmers are powerless to price their own produce, and they end up selling their product at the cheapest price. Moreover, suppliers occasionally fail to purchase their products because of the supermarket price demands and also because of the quantity and quality of output expected by food retailers (Singh, 2011).

According to the World Bank (1995), free trade in the global market was capable of accomplishing higher productivity and even increasing goods and services at an affordable price for the customer. In that manner, developing and developed countries' economies were part of this big drive, yet small-scale farmers were basically not mentioned in terms of how they will benefit from free trade in the long run (Singh 1996, Singer 1997). Even though the South African Government intended to use different frameworks to improve market access for South African agricultural exports in order to protect local agricultural industries against unfair trade practices, the objectives have not yet been met (Taylor 1997). The Department of Agriculture, Forestry and Fisheries (2012) confirms that small-scale farmers lack dependable and consistent markets, and this has contributed to making less profit in the end, as a result; they focus on product consumption and only make a little profit. Likewise, the issue is that their pricing is not aligned with the market value and they sell their produce at their farm gates (homes) or local markets which obliges them to sell their product at a reasonable or cheap price to the community.

This is not the main purpose of being a farmer, as the government has implemented policies in support of agriculture because they are also a part of the enrichment of the economy all over the world. Norton and Conkling (1974) found that land value was directly associated with distance from the market. Furthermore, land use was clearly divided into two zones: an inner zone where commercial production was near to the market, and a zone of subsistence production where small-scale farmers belonged. As technology improves over time, transportation costs will decline and it is predicted that the influence of distance on agricultural production will also lessen.

According to Goldblatt, (2011) and Bernstein, (2013) in 2010 only 5% of the 85.5 million hectares that were previously owned by white farmers, had been transferred through the land reform system. This shows that the programmes and policies are failing to fully attend to and resolve the issue of land by using a proper progressive plan in order to successfully support disadvantaged farming communities (Bernstein, 2013). Small-scale farmers have been characterised as dependent on government funds rather than being supported by social and government programmes. The government policies have failed to realise that this is not a form of livelihood to be used as a tool for poverty reduction, (Sender, 2016; Sender, 2012; Palmer & Sender, 2006). The challenges faced by small-scale farmers have put a tag on them, by characterising them as less fortunate compared to commercial farmers. However, the agricultural sector continues to be a vital livelihood activity among people living in rural areas. (Machethe, 2004; Pauw, 2007).

### **2.3.1. Agriculture legislation**

The following list of Acts reflect and further elaborate on the legislative mandate of the national Department of Agriculture in South Africa. They are presented here and the table provides a comprehensive list of Agricultural legislation that drive and influence the Agricultural development function. The legislation /policies play a vital role in managing and controlling agricultural activities for commercial and small-scale farmers.

### 2.3.2. Table 1. Legislation and key responsibilities

Legislation /policies	key responsibilities
The KZN Animal Protection Act 4 of 1987	Mainly for capacity building, education and awareness creation, monitoring and compliance enforcement.
Conservation of Agricultural Resources Act 43 of 1983	Assists with assessment and approval of development rights.
Marketing of Agricultural Products Act 47 of 1996	Focuses on monitoring and creation of access to markets also the development of compliance regime and enforcement of compliance provision of infrastructure.
Control of Market in rural areas ordinance no 38 of 1965	The compliance enforcement and monitoring evaluations.
Subdivision of Agricultural Land Act 10 of 1970	Serves as the provision of a framework in implementation of regulations awarding of rights control.
Plant Improvement Act 53 of 1976	Focuses on policy development.
Agricultural Pests Acts 36 of 1983	Focuses on policy development.
Agriculture Law Extension Act of 1996	Assists with the provision of extension parameters, also provision of regulatory frameworks, and provision of support programmes.
KwaZulu General Law Amendment Act 3 of 1987	Assists with the provision of extension parameters, also provision of regulatory frameworks, and provision of support programmes.
KwaZulu General Law Amendment Act 21 of 1988	Assists with the provision of extension parameters, also provision of regulatory frameworks, and provision of support programmes.
National Veld and Forest Fire Act 101 of 1998	Contributes the guideline in the preparation of district and provincial disaster management framework.

Veterinary & Para-Veterinary Professions Act, 1982 (Act 19 of 1982)	Provides education in awareness creation and Code of conduct and compliance enforcement.
Livestock Improvement Act, 1977 (Act 25 of 1977)	Helps in expanding the capacity building Infrastructure development. Programmes initiation and implementation.
Meat Safety Act, 2000 (Act 40 of 2000) Replacing Abattoir and Cooperation Act (XXX)	The development of a regulatory framework for: <ul style="list-style-type: none"> <li>✓ Provision of safe, wholesome and safe food of animal origin</li> <li>✓ Prevention of illegal slaughtering</li> <li>✓ Approving abattoir planning</li> <li>✓ Creation of awareness</li> </ul>
South African Medicines and Medical Devices Regulatory Authority (Act, 1998)	Asserts the creation of a regulatory framework for compliance and enforcement.
Animal Diseases Act 35 of 1984	Provides monitoring and control.
Water Service Act, 1997 (Act 108 of 1997)	Arrangement and determination of acceptable water harvesting methods and monitoring of water quality.
Agricultural Research Act, 1990 (Act 86 of 1990)	Determinant and identification area for research support and research institutions establish an archival database.
Agricultural Products Standards Acts, 1990 (Act 119 of 1990)	Establishing norms and standards of policy development compliance.
Agricultural Produce Agents Act, Act 12 of 1992	Mainly for policy development and compliance enforcement.
Agriculture Development Fund Act, 1993 (Act 175 of 1993)	Identify funding requirements in support of stakeholders programme alignment agriculture financial support.
Perishable Product Export Control Act, 1983 (Act 9 of 1983)	Mainly for policy development and compliance enforcement.
Fertilisers farm feeds, Agricultural Remedies and stock remedies Act (Act 36 of 1947)	Mainly for policy development and compliance enforcement.
Agricultural Credit Act, 1966 (Act 28 of 1966)	Mainly for policy development and compliance enforcement.
Marketing Act 1968 (Act 59 of 1958)	This platform helps with monitoring and creation of access to markets, with development of compliance regime, enforcement of compliance, provision of infrastructure.
Plant Breeders Right Act (Act 15 of 1976)	Establishment of a regulatory framework and monitoring and compliance.
Land Redistribution Policy for Agricultural Development date?	For policy development.
Agricultural Debt Management Act, 2001 (Act 45 of 2001)	For policy development.

Soil User Planning Ordinance (Ordinance 15 of 1987)	For policy development.
Hazardous Substances Act, 1973	For policy development.
Genetically Modified Organisms Act, 1997 (Act 15 of 1997)	For policy development.
Medicines Control Act 101 of 1965	For compliance and Monitoring.
Foodstuffs cosmetics and disinfectants act 54 of 1972	For compliance and Monitoring.
Conservation of natural resources Act 43 of 1983	For compliance and Monitoring.
National Environmental Management Act 107 of 1998	For compliance and Monitoring.
Co-operative Act,1981 (Act No.91 of 1981)	For compliance and Monitoring.
Agriculture Laws Extension Act,1996 (Act No.87 of 1996)	Mainly to provide an extension of the application of laws relating to agricultural matters to certain territories.
Subdivision of Agricultural Land Act Repeal Act,1998 (Act No.64 of 1998) President by proclamation in the <i>Government Gazette</i>	For improving rural livelihood and improving livestock while increasing production, improving environmental management, and enabling rural communities to use land more sustainably.
Agricultural Laws Rationalisation Act,1998 (Act No. 72 of 1998)	Mainly for providing for the rationalisation of certain laws relating to agricultural affairs.
Agricultural Debt Management Act,2001 (Act No 45 of 2001)	Focuses more on providing debt agreement, interest rates, the collection of bonds and property.
Land and Agricultural Development Bank Act,2002 (Act No.15 of 2002)	Specialises in serving South Africa's commercial and emerging farmers and provides specially designed financial services.
KwaZulu cane Growers Association Act Repeal Act.2002 (Act No.24 of 2002)	Mainly for the management of assets, including the balance of levies as at the commencement of this Act, this also benefits small-scale cane growers in KwaZulu Natal who pay levies in terms of the KwaZulu Cane Growers Association Act.

Source: DAFF 2013

Even though there are countless policies listed in the table above and Acts in support of agriculture in SA, the same policies and programmes are mostly used by and useful to people who are literate and know the platforms to consult when they are in need of governmental interventions. According to the United States Department of Agriculture (1980), the agricultural productivity statistics are imperative for identifying the source of economic growth. Through the productivity statistics, the department is also able to

justify the appropriation of agricultural research funds in order to fully serve as an indicator of technical changes and justify price changes. Even though the government's contribution has been limited to creating policy instruments for the improvement of productivity within the sector, its involvement on researching and productivity has been limited. Through agricultural productivity, the performances and guide to efficiency of the sector are easily measured based on the available data (Thirtle & von Bach, 1993; Thirtle, Piesse, & Gousse, 2005; Kirsten Vink, 2003 & Conradie, Piesse, & Thirtle, 2009). The updated information on agricultural productivity accessibility assists the department to carry out testing and continuously questioning the validity/accuracy of the statistics from other statistical services, to ensure a greater degree of consistency and quality in official statistics over time. The accurate statistics also help DAFF to verify its competitiveness internally and globally. Moreover, DAFF as a department can understand from the spending or investment how urgent it is to enhance policies when needed to improve agricultural output. With so much information, small-scale farmers are not isolated since they are not big corporates, and there is a least of policies mainly for developing them. Furthermore, accurate and reliable statistics have been perceived as contributor to the national economy, and ultimately improving the lives of the poor in rural and urban areas.

### **2.3.3. How the policies have affected agricultural output?**

In South Africa, agricultural output grew at an average of 2.9 % per year in the 1980s compared to the 1960s and 1996 where it slowed to 1.4% (Wiebe, Schimmelpfennig, and Soule, 1998). This was due to policy modifications around the 1980s which contributed to the removal of existing controls over the movement of labour and microeconomic deregulation which also impacted the significant increase in various activities in the informal economy. The decline in state expenditure in agriculture because of the lack of support for the producer price of maize left farmers devastated (Kirsten, 1988). Moreover, the go-slow of overall agricultural output was because of the decline drag in overall field crops output, which was outperformed by the growth in the horticultural sector, which was as a result of reconfiguration of market share (Groenewald, 1964)

#### **2.3.4. How the policies have impacted agricultural input?**

Agricultural inputs, in general, have varied in terms of growth and between commercial and small-scale farmers. There has been a structural adjustment in farmland used since 1910. In 1960 farmland grew to 91.8 million hectares, but declined in 1996 to 82.2 million hectares (Ann, 2019). Between 2000 and 2007 it remained steady at around 83.7 million hectares (Conradie *et al*, 2009). As a result, only a few people have large farms, while a large portion of the population is in smallholdings and have little or no education at all. The inference is that investment in human capital acts as an obstacle to the effectiveness of extension programmes and technological change. The improved inputs have been used in the coastal region where the large holdings are concentrated and they are already benefiting from technological change and policies.

The demand for agricultural machinery and tractors is also concentrated in the coastal region, which raises the question of where this puts black farmers in future. A specific reflection is that agricultural investment has been unfavourably affected by high inflation, the external debt calamity and hence lower availability of funds, as well as political violence (Velazco, 2001). According to Head (2020), from the latest crime statistics, in Hartswater Northern Cape a family of three was murdered during a farm attack in July 2020. Farm attacks are not based on race. People in rural communities are suffering from a decline in food production capability and, as a result, the killing is not directed at white people only; black, Indian and coloured people are also victims. Crime in rural places have surged ten-fold, with a total of 182 farm attacks being reported in the first six months of 2020 (*ibid*).

#### **2.3.5. Structural policies and institutions**

Economic growth has been enriched by public policies and small-scale farmers, even though the inactiveness of some policies has led to most of the difficulties and challenges in agriculture. Disagreement arises over which policies are most beneficial for growth and the sequence in which policy changes must be undertaken by the developing countries. As a result, one can agree that government can, and do, influence long-run growth in either case.

According to Levine, Loayza and Beck (2000), the determinants of growth in education, financial systems, and trade liberalisation have been used by the government as a support for the major factors of structural institutional arrangements to drive economic growth. Moreover, as Sen (1980) states, development is not primarily for a group of people, but individuals activating their potential and capabilities. The category associated with economic growth is trade liberalisation. As the literature points out, trade affected economic growth while benefits to the disadvantaged declined (Lederman and Luisea, 1997). Firstly, trade liberalisation leads to sophisticated specialisation. Secondly, it encourages the expansion of potential markets, which permits domestic firms to take advantage of economies of scale. Thirdly, trade liberalisation disseminates technological innovations and improves managerial practices. Fourthly, free trade reduces anti-competitive practices by domestic firms. The majority of empirical confirmation indicates that the relationship between economic growth and international openness has been positive.

That reflects a beneficial cycle by which more openness leads to an improvement in economic growth which, in turn, generates more trade for big companies and corporates (Lederman and Luisea, 1997). Government support on the other side has been with regard to essential structural policy, which is related to the government's spending on rural infrastructure, advancing agricultural research, health and education for the stimulating of agricultural growth. As a result, this definitely leads to high rates of employment and income-earning and creates better opportunities to access cheaper food prices (Lederman and Luisea, 1997).

However, small-scale farmers want to grow their business without depending on government financial support all the time. It is well noted that suitably structured and effectively managed government expenditure is capable of enhancing investment. A substantial amount of literature has proposed that governments need to allocate sufficient budgets to agricultural research, irrigation development and rural infrastructure, also to improve roads and electricity supply. (Department for International Development (DFID), 2005).

### **2.3.6. Stabilisation policies**

According to Fatas, Mihov and Rose (2004), the stabilisation of macro-economic differences has affected the cyclical fluctuations, and also the long-run economic growth. In fact, the cyclical and trend growth are interrelated processes, which implies that macro-economic stabilisation and crisis-related variables do have an impact on short-term horizons, and also the long-run performance of the economy (Fischer, 1993). Financial policies and fiscal monetary have been suggested as the contributing tools to a stable macro-economic environment and prevention of financial and balance-of-payments crises for developing and developed countries.

## **2.4. DEBATE ON THE IMPACT OF TRADE LIBERALISATION ON ECONOMIC GROWTH**

Economic growth and the influence of trade liberalisation on poverty reduction remains controversial among many researchers (Daniel and Sunday, 2002). It is then the main purpose of the trade liberalisation to be beneficial to poverty reduction. Rodriguez and Rodrik (1999) have criticised sentiments that associate trade openness with more rapid economic growth. As a result, they indicated that there is a lack of control of the indicators of economic growth, which has put a greater burden on poor people, including small-scale farmers.

Rodrik (1999) continues to criticise the whole concept of trade policy on its own and added that it is an unreliable instrument for generating successful agricultural productivity and economic growth, based on inefficiencies in delivering improved market access for small-scale farmers, geopolitical interests and other factors. To get a better understanding of trade liberalisation, Dollar and Kraay (2004) studied the impact of trade liberalisation on countries classified countries into globalised and non-globalised economies according to their GDP. Their study showed that trade liberalisation accelerates economic growth, with the former group (the globalised economies) having experienced higher growth rates as a result of trade liberalisation.

Ravallion (2001) takes a more judicious position, indicating the need for more country-specific research because there are countries whose status of 'developed' or 'developing' makes them benefit differently.

Santos-Paulino and Thirlwall (2004) stated the effect of trade liberalisation on a country's economic growth. Manchin (2005) concentrated on African, Caribbean and Pacific (ACP) countries that were using threshold estimation to test preferential access to the EU. The findings of the study showed that ACP countries have failed to take advantage of the preferential access status. For example, the share of world exports from ACP countries fell from 3.4% in 1976 to 1.9% in 2000; similarly, EU imports from ACP countries decreased from 6.7% in 1976 to 3.11% in 2002 (Coetzee, 2008 and Manchin 2005).

The trend proved that these countries need to consider their decision to request preferences, and as a result, they will be able to take into account the cost of production factors, comparing the quality of products, competitiveness, quality of infrastructure and institutional qualities. This applies, more specifically, for developing a multi-country model mainly focusing on southern Africa, and easily analysing the impact of tariff reduction on African economies both in a regional and a global context (Lewis, Robinson and Thierfelder, 1999).

#### **2.4.1. Impact of trade liberalisation on agricultural productivity in Africa**

There is a strong connection between export expansion and economic growth. Yet there is a challenge whether the small-scale farmers in Africa can participate effectively in international specialisation and participate in the 4IR and benefit by using their skills. According to the FAO, (2003) such participation requires farmers to produce more agricultural output in order for the costs and risks of engaging in trade to be reduced. Over the years the increase of trade liberalisation has caused manufacturers' and farmers' prices to decline and farm input costs to rise. As a result, small-scale farmers in particular are unable to invest and commercialise their production activities and they lack suitable guidance for structural transformation, even though in Africa there is some evidence that output marketing reforms have been connected with increases in land and labour productivity at an aggregate level.

The increase is due to progressive shifts in crop mix and the geographical location of production rather than the intensification of existing farming systems (FAO, 2003). There is even less evidence that food marketing reforms have led to the strengthening of the key food crops. Also, crop mix shifts have often been mainly for crops whose output markets were not liberalised, such as cotton in Burkina Faso and Mali, groundnuts in Senegal and coffee in Rwanda. However, this does not suggest that cash cropping incentives have not benefited from marketing policy reform in key maintenance crop sectors. For a very long time, the cash crop growers have gained directly from pre-harvest support delivered under commercial farmers schemes (FAO, 2003).

## **2.5. MARKETING (Agricultural product Act (Act No 47 of 1996)**

in January 1997 Marketing (Agricultural product Act No 47 of 1996 came into effect and was based on the view that state intervention in agricultural markets should be the exception rather than the rule. The weakness of the Act is that it does provide for a certain number of limited interventions. As a result, small businesses were not well favoured for the future. According to DAFF (2013), the Act focused on the collection of levies, the keeping of records, export controls and compulsory registration. Additionally, any proposed intervention based on the Act must be subjected to a review process involving the National Agricultural Marketing Council (NAMC)

## **2.6. FINANCE (Land Bank) National Department of Agricultural (NDA)**

The government has shown some interest in supporting the development of financial services cooperatives, which are referred to as Village Banks. For DAFF (2013) this paved the way for a variety of local financial arrangements for savings and loans, including some well-established schemes, such as the Small Cane Growers' Financial Aid Fund (FAF) providing facilities to some 45 000 farmers. The Bank Act 94 of 1990 was registered under the Co-operatives Act, 1981 (Act No. 91 of 1981). Also, in the North West Province there are joint pilot projects with Village Banks registered as financial services cooperatives. Sen (1980) found that the capability theory also serves as a tool to eliminate external restraints such as funding to small-scale farmers.

According to Newbigin, (2017) and Adendorff, (2015), the policies to promote and protect creativity have been seen to be crucial determinants of success in the 21st century. If the assumptions are true, then it is the duty of mankind to rethink the way governments are organised, and also be observant of the way cities are planned, the way education is delivered, how energy is accessed and electricity is provided, and the way citizens interact with their communities (Newbigin, 2017).

## **2.7. AGRICULTURAL LAND ACT, 1970 (ACT NO. 70 OF 1970)**

Globally, the land is a crucial social, economic and natural resource. Including South Africa, land reform is based on the belief that agrarian transformation is essential for the redistribution of capital assets which were taken away by the 1913 Natives Land Act that created a landless majority in the country (Hall 2004; Cousins and Walker 2015). Many have criticised land reform in South Africa due to its slow progress (Mantashe 2012; Satgé 2013; Khan 2015; Reuters 2016). As a result, the effect of land reform tardiness has delayed agricultural investments, which illustrates the prevailing food insecurity crisis. Also, there is an issue relating to the advantages of commercial versus small-scale farming and their effects on sustainable food production, let alone the inequality among these two agriculturalists (Satge 2013). These days, many people are favouring the idea of land seizure from white farmers without compensation as they are financially and educationally advanced enough to adopt any technological transformation, including the 4IR (Kloppers and Pienaar 2014, 679; Cousins and Walker 2015).

Alexander (2015) asserts that these divergent perspectives highlight the complication of the land reform project. The South African land policy is originated on three pillars: restitution of land or compensation to those that were dispossessed of their land; redistribution to ensure equitable distribution; and tenure reform to validate land rights and afford security under different modes of locally appropriate occupancy. In the 1990s, the National Department of Agriculture initiated the Broadening Access to Agriculture Thrust (BATAT) and the programme provided agricultural services. The main objective of BATAT was to improve access to agriculture for those who were previously excluded by racial laws and policies. The BATAT failed at the planning stage because it lacked proper monitoring and management (National Department of

Agriculture, 2004). Small-scale farmers can consider combining traditional and indigenous farming knowledge with recent scientific approaches to improve their production. Small-scale farmers are clueless about available government financial assistance. Also, the procedures make things worse for older farmers who are determined to keep using old ways. As noted by IFAD (2012) women and young people in agriculture have been deprived of training and as a result, they fail to access accurate information on agriculture enhancements and development. Krall (2015) supports the capability theory by highlighting that education, knowledge and agricultural guidance are essential to sustain small-scale farming, especially in developing countries.

Access to resources, land and water is equally important to commercial and small-scale farmers. The 4IR will assist with the latest information and regular communication about Agri- Tech, and also the same technology will also be playing an increasingly vital role in farming technique. A large proportion of the population in Sub-Saharan Africa depend on agricultural sector employment but farmers are continuously facing policy constraints such as trade policies and land distribution (Sullivan & Pittock, 2014; Development Support Monitor, 2012; Pittock, Stirzaker, Sibanda, Sullivan & Grafton, 2013). The Department of Land Affairs (DLA) in 1997 designed the land reform policy and with it a White Paper while implementation of the programme had already started in 1994. Land reform policy in South Africa consists of land compensation, tenure reform, and redistribution programmes.

Concisely, restitution is related to the historical land rights of people that were previously forcibly removed by the state. The objective is to serve justice by returning the land to the owners or by providing a cash equivalent. The redistribution of land focuses on the transformation of existing, racially-biased land ownership patterns that have hindered disadvantaged farmers. Its scope comprises the urban and rural poor, farmworkers and labour tenants, as well as new entrants to agriculture.

The formal target set by the State for the land reform programme is to transfer 30% of the land, which had been owned by white commercial farmers in 1994, which amounts to some 25 million hectares (Binswanger-Mkhize, 2014). By the year 2000, land transfers had decreased compared to other periods since the beginning of the

programme. Again, in October 2000, it was reported that only 0.81 per cent of land had been transferred back to the owners.

### **2.7.1. Land Reform and Redress**

According to Aliber and Cousins (2013) redressing the issue of land reform has been a failure both in terms of the pace and strategies used to redistribute land to its rightful owners. According to Binswanger-Mkhize (2014), the reason behind the high failure rate of projects is the application of group or cooperative farming models. The officials comprise beneficiaries in classifying, planning and developing their farms and guarding beneficiaries' investments. Additionally, these leases do not serve any purpose because they are typically subject to constraints such as performance agreements or require participating in training programmes, and the international research has shown that these leases have been cancelled (Binswanger-Mkhize, 2014). In that manner these leasehold titles act as a disincentive for long-term investment and are not used as security for loans, thereby making it difficult for beneficiaries to raise capital.

Musa, Aboki and Audu (2013) state that communication amongst farmers has been achieved through agricultural extension aiming to support and facilitate farmers' agricultural activities and growth of production. According to Cloete (2010) and Grobler (2011), both commercial and small-scale farmers receive financial support from the government. Moreover, communication among farmers has been well established through agricultural extensions, such as the usage of cell phones. The 4IR technologies and agricultural communication platforms to educate farmers are videos, internet, radio and newspaper about agriculture techniques among small-scale farmers have been achieved but they are not sufficient (Parikh, Patel & Schwartzman, 2007). Additionally, Sen (1980) observed that people as individuals bring different views based on their

experience of development and they grow together to accomplish more. As for small-scale farmers, without making them feel intimidated by all the flashy and expensive agricultural technologies there is still a lot to grasp from old networking platforms such as television and radio.

According to Machethe, (2004) and Dercon, (2009), the population by 2050 is expected to be 9 billion and most people are depending on social grants, meaning the increase of population contributes to economic challenges. Even though the advancement of revolutions aims to provide for people, again the lower class will add to the poor population. Small-scale farmers do not consume more nutritious diets compared to other rural households, they even struggle to substantially raise income and profit from their production. The old-age pension (OA) enables the poor to improve small-scale farmers households and receive the right nutrients (Posel, Fairburn, & Lund 2006), while Fields (2011) emphasises that the small-scale farmers in developing countries are formal labour markets but too small to absorb a large number of the labour force into employment. Consequently, small-scale farmers are perceived as typically black, landless, poor, farms on very small pieces of land for household maintenance and the majority of farmers depend on social grants (Fenyess & Meyer, 2003; Groenewald & Nieuwoudt, 2003; Lahiff & Cousins, 2005).

According to the Department of Agriculture, Forestry and Fisheries (2012), the implementation of agricultural cooperatives in South Africa was initiated by the Afrikaner nationalist movement. The movement established three types of cooperatives, namely, marketing, supply and processing. These cooperatives grew rapidly after the establishment of the Land Act in 1912 as they benefited greatly from apartheid government support, which excluded the poor black people. According to DAFF (2012), from the 1940s, the same cooperatives also enjoyed subsidies under the Marketing Act of 1937. Although the Apartheid regime in South Africa recognised black cooperatives in rural areas, these cooperatives certainly did not enjoy equal privileges with the white cooperatives. As a result of this, inequalities persisted and the black cooperatives could not develop as much as their white counterparts (DAFF, 2012). This is why small-scale farmers are struggling even today. The South African government however signed into law in 2005 the Cooperatives Act (No 14 of 2005). This act was mainly focused on seven international principles, namely, voluntary and open membership, democracy, autonomy and independence, equitable and fair member participation, regard for the community, access to training and education, as well as cooperation among cooperatives (ICA, 2005).

According to DAFF (2012), on 31 January there were 54 461 registered cooperatives in South Africa. The Agricultural sector in total is about 47% of the total number of cooperatives in the country. The agricultural cooperatives, especially small-scale farmers, are challenged by a lack of demand for their produce, caused by failure to access lucrative domestic and international markets. Even though the South African government has been trying to redress this situation by introducing incentive schemes aimed at encouraging the establishment of secondary marketing cooperatives, the incentives are limited to small-scale farmers. The secondary marketing cooperatives mandate is to reduce marketing transactional costs (DAFF, 2012).

Since 1994, South Africa has centred on the magnitude of land restitution and redistribution from white to black owners, which is expressed as a percentage of the total area of agricultural land during apartheid (Khan 2015). The 1913 Land Act signalled the denial of black South Africans' rights to ownership, and also the use and access to land which most the black people would have benefited from. Kloppers and Pienaar (2014) observed that the discriminatory practices and laws lead to extreme inequality in relation to land ownership and land use and continue to impact the lives of the poor. The difficulty is that the first democratic government adopted a twisted and racially-based land procedure in which gave the minority white population 87% of the land, while black South Africans were left with 13% (Walker and Dubb 2013). According to Lahiff n.d.,( 3), in 1996, the South African population was 40.5 million people (Black – 76.7%, White – 10.9%, Coloured – 8.9%, Indian/Asian – 2.6% and Unspecified /Other – 0.9%). Years have gone by and by 2012, 67% of the land was held by white farmers, while 15% comprised black communal areas and 10% was owned by the state, while 8% was used for other purposes, including urban areas (Walker and Dubb, 2013). What is clear is that among other push and pull factors the struggle for land was one of the reasons for massive support for the liberation movement during the apartheid era (Mantashe, 2012).

Land reform is imperative in order to reverse the massive land dispossessions suffered during apartheid and the government has shown more interest in supporting black people. Moreover, the land policy objectives are to ensure the security of tenure for rural occupants, to remove overcrowding and provide housing and productive land to the underprivileged within rural areas (CDE, 2008). It was soon clear that the failed

land project would have dreadful effects on the state and its economy let alone on the development of people to the development of people. The main focus of land reform is to redress the inequalities of apartheid, improve household welfare and alleviate poverty (Department of Land Affairs ,1997). The post-1994 government land reform endeavour regards land reform as a liberationist agenda aimed at addressing inequities of the previous political dispensation.

The intention of redistribution is to grant access to land to the disadvantaged and those previously denied the right to own it. The Restitution of Land Rights Act, Act 22 of 1994 is responsible for equitable redress for South Africans ejected from land as a result of racially motivated laws or practices that officially commenced in 1913 (Kloppers and Pienaar 2014; Khan, 2015). This relates to the point made by Chenwi (2008) who posits that state policies and the apartheid legal framework that dispossessed black people of land resulted in the persistent evictions confronting the country at present. Chenwi (2008) carried on to emphasise that before majority rule in 1994, millions of black South Africans experienced deliberate indiscriminate eviction from informal settlements as a result of 'influx control' policies.

The land is an essential source of livelihood for the black population especially and is a form of natural capital in agrarian and rural settlers. Denial of land for this purpose exacerbates poverty for many black people all over the world. According to Hall (2004); Bradstock (2007, 23 ); Johane and Muchapondwa (2013); Walker and Dubb (2013); Mputing (2014); Khan (2015); Lahiff (n.d.) the government's failure to use land reform as a mechanism of agrarian reform encouraging agricultural productivity have delayed the progress of small-scale farmers. Furthermore, the lack of land reform has contributed to an absence of human capacity development and the failure to sustain agrarian structure because of the twisted land arrangements impacting the rural population. This action has accelerated the rising levels of rural-urban migration, and

motivated land hunger and land conflicts, the drop in employment rate, and the impoverishment of the rural population. The lopsided land arrangements and poverty in South Africa have brought unnecessary struggles for black people and influenced their livelihood and progress, as they have become more dependent on government grants (LAMOSA n.d.). Small-scale farmers in South Africa have experienced being agriculturally unproductive in rural areas. Additionally, about 70% of the population lives below the poverty line.

According to Adams and Howell (2001), South Africa implemented a market-assisted or demand-led process whereby succeeding applicants were given permission to purchase farms of their choice from willing sellers. This model has significantly obstructed the efficiency of the government reform agenda. The market-led approach to land redistribution, which is stimulated by the International Financial Institutions (International Monetary Fund and the World Bank) is unsuccessful because the rural poor have no financial aptitude to buy farms, and government financial support is insufficient (Hall 2004; Lyne n.d.).

According to Hall et al., (2003) and Hart 2008, (2011) policies and programmes implemented post-1994, including the *1995 White Paper on Agriculture*, the *1998 Agricultural Policy in South Africa* discussion document, the *2001 Strategic Plan for South African Agriculture* and the *2004 Comprehensive Agricultural Support Programme*, are all guilty of the criticism that there is a lack of support for the poor and more vulnerable farmers, particularly female farmers. Salie (2020) asserts that the ANC has been in government for 26 years, yet over this period, the unemployment rate has risen, poverty has worsened and socio-economic issues have been exacerbated by some of the policies implemented from the pre and post-Apartheid era.

According to Vink & Van Rooyen (2009), South African government's post-1994 policies and programmes attempt to increase the equity among farmers and correct the social and economic errors. Poor policies and programmes also impacted racial and gender representation and access to land, and, worse, influenced the access and modern technologies (new crop and livestock varieties, agrochemicals) and other

inputs (4IR). Even though the *New Growth Path* (Economic Development Department, EDD 2010) and *Vision 2030* (National Planning Commission, NPC 2011) have recommended and proposed agriculture as a key driver of rural economic development and job creation there is a residual deficiency of policies and programmes. De Janvry (1981) points out that in many countries, progressive improvements are brought about by land reform programmes and sustain black small-scale farmers.

There is a discourse that governments perform very well in acquiring land but fail to rightfully distribute land to its rightful beneficiaries (DRDLR, May 2018). One may argue that the land reform programmes often became part of a system of political benefaction. This is due to the postponement of the LRAD and SLAG programmes that took place in 2006 when there was a steady redistribution to individual owners, while the government has acquired and still owns a total of 2.2 million hectares (or 2.8%) of farmland under the Agricultural Land Holding Account (DRDLR, May 2018). Based on the numbers provided by Minister Nkwinti in February 2017 and DRDLR in May 2018 there is slow progress.

According to Wiebe *et al*, (2001) the impact of agricultural policies on and lack of investment in productivity in sub-Saharan Africa, especially in Zimbabwe and South Africa, have delayed the progress in agricultural output. The agricultural policies on and investments in commercial and smallholder agriculture have impacted output because of skewed policies hindering development in land productivity in both countries. Production in Zimbabwe increased by an average of 1.3% and in South Africa, it improved by an average of 0.6% per year. Also, labour productivity improved in South Africa by an average of 1.3% while it decreased by 0.7% in Zimbabwe per year. In both developing countries, the government interventions favoured European farmers over African farmers and, as a result, the policies failed to serve their purpose. In the 1970s and 1980s, the total factor productivity (TFP) growth for the commercial sector in Zimbabwe was at about 4.0% and in South Africa it grew by 1.3% between 1947 and 1991, increasing to 2.9% in the final decade leading to independence. Apart from agricultural policies which are a hindrance to small-scale farmers commercialising their businesses there are other challenges that will be discussed in the next chapter

## **CHAPTER 3**

### **REVIEW OF RELEVANT LITERATURE AND THEORETICAL FRAMEWORK**

#### **3.1 Introduction**

The importance of agricultural productivity in South Africa can be traced back to 1910. To a certain extent, there is interesting literature on the trends of agricultural productivity internationally. The trends have been used as a tool to outline the factors affecting agricultural productivity and also providing techniques to improve agricultural productivity in developed and developing countries. Various authors Liebenberg & Pardey, (2010); Conradie, Piesse, and Thirtle, (2009) have shown interest in estimating agricultural productivity over the years and the role it has played, especially in developing and sustaining poor people. The evaluations produced by various studies have revealed that, over the years, agricultural productivity has been inconsistent because of many challenges experienced by farmers along the way. Additional to the existing agricultural crises is the lack of proactive policies that have failed to fully support small-scale farmers in order to participate in revolutionary movements and enrich the South African government's economic system.

However, there is a deficiency of work on the level of agricultural output at the regional and enterprise-level in these countries, especially in developing countries. The high investment in research and development in labour, land and capital have influenced the improvement in the use of inputs such as fertilizer, machinery, and other agricultural equipment. For decades, productivity has primarily depended on technological change, in order to improve input efficiency and preservation of natural resources. Even though there is still a gap in investments in agricultural research, extension and human capital, including agricultural settings. As a result, countries that fully participate in technology are likely to yield greater agricultural output. For instance, according to Chang & Zepeda (2001), in 1987/94 labour productivity in China increased by 4.13% whilst that of the United States was 7.16%.

The first, second and third revolutions have contributed massively to different sectors and most countries have adopted the use of technology to increase production at a

lower cost. The components parts of the 4IR will be discussed after firstly recalling the previous revolutions and their main role in agriculture. This will help to paint a clear picture of the necessity of improving the revolutions and answer the question of why countries should take part in technological advances such as the introduction of the 4IR into agriculture and its full implication for small-scale farmers. Moreover, looking at South African agricultural sectors, how will farmers, especially small-scale farmers, gain from the 4IR while there are unresolved issues relating to agricultural policies /legislation. As a matter of fact, the imperative of harnessing agriculture and 4IR technologies is nowadays being shared on many platforms, but with less clarity on how it will work for small-scale farmers. This section will unpack the dual agricultural system which was implemented by the government. Along the way, the same structure will be reviewed as to whether it was a virtuous tool to support black farmers. With the support of classical/political and capability theory in the analysis in this study, it is very important that this section makes the most use of the literature available.

### **3.2.THE BEGINNING OF AGRICULTURE UNIVERSALLY**

According to Mokyr and Nye (2007), by 1700, Britain was ahead compared to other countries due to a high degree of urbanisation and a small share of the economy devoted to agriculture. The 1st Industrial Revolution was introduced in 1750 and lasted until 1840, triggered by the invention of the steam engine. The subsequent construction of railroads contributed to the importance of using machines to expand production. The British Agriculture Revolution, or Second Agriculture Revolution, was the unprecedented increase in agricultural production in Britain due to the increase in labour and land productivity between the mid-17<sup>th</sup> and late 19<sup>th</sup> centuries. Agricultural output grew faster than the population over the century to 1770, and thereafter productivity remained among the highest in the world (Mingay,1977). This increase in the food supply contributed to the rapid growth of population in England and Wales, from 5.5 million in 1700 to over 9 million by 1810, though domestic production gave way increasingly to food imports in the nineteenth century as the population tripled to over 35 million. According to Richards & Hunt (1983), the rise in productivity accelerated the decline of the agricultural share of the labour force and also contributed to the increase in the urban workforce on which industrialisation depended.

According to Jones (2016) and Mokry (2009), one Important change in farming methods was the move in crop rotation to turnips and clover in place of fallow.

### **3.2.1. The role of the 1st,2nd,3rd and 4th revolutions in agriculture globally**

Over the past three centuries, the industrial revolution has been the most significant development in human history (Stearns, 2018:1). In the history of human society, the industrial revolution has played a major developmental role with regard to change and transformation. It all started with the use of machines, electricity and telecommunications, leading to the new developments in many forms of technology obtainable at present. The industrial revolution changes have also involved government policies to guide government services which include social and economic aspects of society. According to Roberts (2015:1), the First Industrial Revolution (1IR) was at its strongest in Britain between the 18<sup>th</sup> and 19<sup>th</sup> centuries and later on, the rest of the world adapted to it. This change also improved the stock exchange, which led to the rise of banks, financiers, and increased private investment. The revolution also assisted communities to expand and develop from agricultural activities to the use of mechanisation.

As pointed out by Roberts (2015:1) people around the world, but mainly in Europe and North America, started to develop innovative ways of expanding business and dealing with social issues. While all changes and transformations improved business production, they also brought new possibilities, responsibilities, and abilities to humans. Agarwal and Agarwal (2017:1063) rightly observed that with the improvement of the living standards there were new skills discovered which increased the production in businesses. Even though the 1<sup>st</sup> industrial revolution enhanced the production for different sectors and businesses, it is important to recognise the significance of alterations in farming and agriculture from the mid-1600s. This took place across Britain and paved the way for the Industrial Revolution. As a result, the practice of the 1<sup>st</sup> industrial revolution components which occurred in agriculture was determined by the demand for more food to support Britain's growing population (Easton, Carrodus, Delaney, Howitt, Smith, Butler, and McArthur, 2014.) These changes were recognised as the 'Agricultural Revolution'. Moreover, the changes in industrialisation made it possible to improve production in different sectors from 1750

onwards. For Hobsbawm (1996) the practice of technology and capital investment in developing and developed countries has brought relief from extreme poverty. For example, the 1840s when agricultural science and engineering were considered to have reached maturity and introduced the rest of the revolutions. The vast increase in output of British farming took place in the 1830s when it achieved its greatest general implementation of methods pioneered earlier in the 18th century.

Hobsbawm (1996) noted that even though the implementation of the 1<sup>st</sup> industrial revolution contributed to a sharp decline in the percentage of the population employed in agriculture, the ratio was still one in four Britons employees working in the fields in 1850. According to Voth (2003), the 4000 Enclosure Acts that were passed by the British Parliament affected the number of employees hired and the Agricultural Revolution also transferred regions that were common land and previously worked by small groups of local farmers to be fully owned by private landowners. It did not end just with newly introduced agricultural laws but these particular areas of land were joined together to create large farms enclosed by hedges or stone walls. As a result, by 1790, three-quarters of all farming land in Britain belonged to and was enclosed by wealthy landlords. These wealthy landlords started to rent the land to tenant farmers, affecting many poor people, leading to social unrest and people leaving farming. This is one of the factors that led to migration.

Easton et al (2014) argue that the 1<sup>st</sup> industrial revolution improved agriculture, giving it a new commercial approach and enhancing the management of crops. Farmers used the 'four-field system' which separated each season and was based on the importance of crop rotation. Farmers in the mid-1800s were introduced to new farming machinery, for instance, the mechanical drill, which was mainly used for planting seeds. Instead of employees performing farming chores there was a reaping machine for harvesting crops. These types of machine-made farming were more efficient and increased profitability and as a result, the employment of farm workers started to decline.

### **3.2.2. Agriculture in the 2nd Industrial Revolution**

The Second Industrial Revolution (2IR) continued from the previous era and began in the early 19th century. The 2IR focused more on the technological developments in areas such as steel, chemicals, electricity and other fields of technology (Agarwal and Agarwal 2017:1063). The 2<sup>nd</sup> Industrial Revolution introduced electricity, with the aim of increasing mass production. However, agriculture differs from other sectors because it performs in large fields and the quality of the effort by farmers is only appreciated after harvest (Persson,2010.) In 1868 agricultural productivity significantly improved because most farmers were familiar with fertilizers, and they also learnt to use nitrates, potassium, and phosphates which were produced by the chemical industries.

The technological progress affected food supplies in many ways and enhanced the output. According to Mokyr (1999) the utilisation of drainage and irrigation pipes, steam-operated threshers, seed drills, mechanical reapers and steel implements enriched productivity and extended the supply of food and raw materials. However, adoption was slow because the agricultural machines failed to overcome some of the technical difficulties that farmers faced'. Mokyr, (1999) added that agriculture relied on the power sources brought to the production site (usually land) to perform most of the activities, for instance, raking, ploughing, harrowing, reaping, and binding. All this was accomplished by employees and by the use of animals long after manufacturing and transportation had adopted the steam engine. The internal combustion engine introduced the tractor.

### **3.2.3. Agriculture in the 3rd Industrial Revolution**

According to Roberts (2015), the 3IR began in the mid-1900s and was pushed by the development of technological innovations in distribution and manufacturing, and energy factors. Roberts (2015) also emphasises that the 3IR was able to develop nuclear power, which made it more powerful than the previous revolutions and it also contributed to the wide use of electronics globally. McKenzie (2007) noted that the computer, or digital, revolution, was introduced during the 3rd industrial revolution in the 1960s, with the development of semiconductors and mainframe computing (1960s). The rise of personal computing in the 1970s and 80s and the introduction of

the internet in the 1990s became the main driver and created more communication platforms. In 1960 the world population reached 3 billion and as a result, it was essential to introduce the “industrial” era in agriculture.

Industrial methods in agriculture became widespread first in Western Nations, assisted by the rapidly increasing use of chemical inputs; mechanisation of farming and food production became the norm. Furthermore, there was an increase in the number of animals confined in crowded indoor facilities. Yields increased dramatically year on year, along with significant hidden costs. The “Green Revolution” was initiated because of agricultural improvement. Even developing countries slowly adopted ways of eliminating hunger by improving crop performance and also increasing yields by introducing irrigation, new crops, fertilizers, pesticides, and mechanisation. Moreover, increasing technological knowledge, mechanisation, and supplying materials to farmers. The green revolution assisted in restricting hunger, but it did not eliminate famine. Unfortunately, it also led to increased costs of production and negative environmental impacts (McKenzie 2007). Therefore, the technology approach does not assure a secure food supply and one can argue that it is often not environmentally sustainable.

According to Piper (2017), agricultural technologies advanced rapidly yearly in the second half of the 20th century and into the 21st. These technological developments changed the face of agriculture forever and enhanced production and agricultural output overall. It is well noted that in 1975 the first twin-rotor system combine was made by Sperry-New Holland, mainly for crop harvesting. In 1982 scientists, at the Monsanto Company were the first in the world to genetically modify a plant cell, and had planted their first outdoor trials of a genetically modified crop within five years. In 1994 satellite technology was introduced to advance farming, enabling farmers to see their farms from overhead, for better tracking and field planting. The use of software and mobile devices in the 2000s started to facilitate the yielding of better harvests.

Additionally, mobile devices allowed farmers to stay connected to co-workers whilst out in the field and gave them access to data needed while on the go. Most importantly they were able to place orders for seed or fertilizer at any time or in any place. In 2015,

the advent of big data also started revolutionising agricultural potential, enabling farmers to utilise data and harness the power of information to make knowledgeable agricultural decisions and allowing them to use resources more sustainably (Piper, 2017).

According to the Food and Agriculture Organization of the United Nations (2015), with the use of technology, agriculture has continued to sustain itself and maintain food security. In 2015, the use of mobile phones for information exchange was used as a platform sharing informative awareness such as disease surveillance and pest tracking. Clearly, with the dramatic progression in technology, the fast train introducing the 4IR industrial revolution has arrived and there is no turning back. In 2011 the German federal government implemented the 4IR as the main theme for the WEF's 2016 annual meeting in Davos, Switzerland (World Economic Forum, 2016).

### **3.2.4. Agriculture in the 4th Industrial Revolution**

The 4<sup>th</sup> industrial revolution not only played a huge role in information and communication technologies (ICTs) in agriculture but expanded broadband connectivity, leading to increasing deployment of the “internet of things” (IoT). Moreover, it enhanced analytics, affordable devices and innovative applications to continuously contribute to the digitalisation and digitisation of agriculture (Food and Agriculture Organization of the United Nations. 2017). Nowadays, the use of digital technologies in agriculture such as smartphones, drones, tablets, in-field sensors, and satellites are considered commonplace. They provide a range of solutions for farmers, such as remote measurement of soil conditions, better water management, and livestock and crop monitoring. According to EIP-Agri, (2017) these have assisted farmers to plan more effectively and also be more efficient, with subsequently improved crop yields and animal performance while accelerating inputs and labour reduction, which increases profitability. Digitalisation has also helped advance working conditions for farmers and reduce the environmental impacts of agriculture.

Technology is now capable of automating cyber-physical systems by networking between different machines. Electronically controlled machines are becoming state of the art and industries are benefiting from it. Weltzien (2016) notes how 4IR

technologies have developed resilient technologies for communication, such as cloud computing and the IoT. They are also converging with other advances such as artificial intelligence (AI), big data analysis, and robotic technologies which are further driving digital agriculture, known as “Agriculture 4.0.” (Ozdogan, Gacar, & Aktas, 2017).

As much as “AgTech” is mostly used by, and is beneficial to commercial farmers the concern is how knowledgeable small-scale farmers are about this system. According to Monitor Deloitte (2016), 4IR technologies have already been used by big corporates, including the agricultural industry, to enhance small-scale and commercial farmers’ activities. There are also several innovators leading attempts to tap into the growth opportunities in increasing supply chain efficiency, improving yield efficiency, and decreasing complexity along farming’s value chain. Monitor Deloitte (2016) further noted that although small-scale are only slowly getting involved, compared to commercial large agrochemical incumbents they are already investing heavily in agricultural technology, or “Agri-Tech.”

The 4IR has allowed agriculture to grow particularly noticeably in countries such as the USA, Israel, China and India and they are pushing the modernisation boundaries (Monitor Deloitte,2016). The Netherlands is another country that is fully participating in terms of agricultural innovation and embracing technology ( Worldatlas, 2017). Agri-tech holds out the significant promise of making farms of the future more productive and efficient, with advances in technology. Farmers are now capable of accessing farm management software, precision agriculture and predictive data analytics, using sensors to collect data and monitor crop health while presenting weather and soil quality. Apart from crops and better yields, animal data have been obtained and controlled via software and hardware to understand livestock. Unfortunately, breeding patterns to genomics and smart irrigation, all these agricultural technologies are more beneficial to commercial not to small-scale farmers (AFGRI,2017). For De Wilde (2016) the challenges faced by agriculturalists are posed by current and future global food supply, which have persisted over years and will continue to thrust agriculture towards technological innovation Since not everything that is technologically feasible will become reality, it is important to assess it in the context of international social, economic and political developments. The 4IR drivers are extreme automation and

connectivity influencing demographic shifts, globalisation, macroeconomic trends and more. Therefore, examining the drivers of 4IR in agriculture only through a technology-lens is deficient, and possibly fails to address the issues faced by small-scale farmers.

### **3.3.THE FEATURES OF THE 4IR**

#### **3.3.1. Big Data**

Complex sets of data are referred to as big data and they are both structured and unstructured techniques able to operate on tracing and obtaining enormous amounts of information (Taylor-Sakyi 2016). Big data enhances insight, decision making, and process automation because it consists of a great variety of information assets that demand cost-effective and innovative forms of processing data. Organisations use big data platforms to analyse and make meaningful decisions based on the data available on their databases. De Mauro, Greco and Grimaldi (2015:98) found that the importance of big data lies in its ability to assist businesses to reveal hidden information. Also, big data enables information to be generated and made available for different business sectors. Even governments and businesses are highly dependent on the amount of information generated by different technological modes for their decision-making.

For instance, it is easy to collect data from a local police station or provincial hospital to categorise a crime hotspot because of the availability of reliable data. However, big data consists of large amounts of information and needs sufficient space for storage, hence the use of new technological inventions to store more data (Ilbery and Hornby, 1983). Agricultural challenges come in the form of short and long term weather variations, uncertain markets and other factors relatedly to farmers failing to obtain prior knowledge of either prices or yields. Behavioural geographers emphasise the need to focus on non-economic factors, such as the age, personal preferences and experience of the farmer. These all need to be taken into consideration as they play a very important role in a farmer's decision-making. Simon (1957) added that some farming decisions made by farmers lack adequate information, and as a result, the decisions lose their meaning and do not improve the farmer's circumstances. However, Wolperts (1964) found that commercial farmers tend to be aware of more than one feasible

option compared to small-scale farmers. When it comes to small-scale farmers they are likely to select the first satisfactory strategy they are aware of, unlike commercial farmers, who are more capable of comparing all the available options and deciding on the one that is the most economically rational model (Hart,1980). Research has found that behaviour characteristics may provide information about agricultural decision-making behaviour.

### **3.3.2. Artificial Intelligence (AI)**

Artificial Intelligence (AI) has existed for the past 60 years, but it also improves its capacity through revolutions. AI has superior intelligence and capacity which allows computers to perform complex functions associated with human intelligence (Alsedrah,2017:3). AI is also described as the capability of machines to learn like humans and also be able to respond to certain behaviours. Nowadays, computers are programmed to accomplish tasks just like human beings and also play a vital role in the production of different sectors. Moreover, it is a field of science providing machines with the incredible capacity to perform human functions such as reasoning, logic, planning, learning, and perception (Perez, Deligianni, Ravi and Yang 2018:2). Overall, AI is computer software with human-like characteristics that have been present in many industries and which contribute to business progress.

### **3.3.3. Robotics**

Among many other scholars Perez, Deligianni, Ravi, and Yang, (2018:24) found that robots are made of mechatronics, computers and electrical engineering. Industries such as car manufacturing and agricultural plants rely heavily on the use of machines for greater production. As pointed out by Karabegovi and Husak (2018:69) the use of robots in industries have made it possible to process any product with less human interaction than previously. Robots have been used in different industries and also contribute more quality production at a faster pace compared to human capabilities, and as a result, big corporates rely more on big machines to produce multiple and higher outputs. Moreover, different companies prefer to use robots in order to perform tasks that are too complex or risky to be performed by human beings. Karabegovi and Husak (2018:69) further emphasise that the presence of robots in different sectors has

surpassed the previous revolutions and, as a result, the future generation will adopt the use of massive technologies.

#### **3.3.4. The Internet of Things (IoT)**

The concept of the Internet of Things (IoT), consists of connections via the Internet which enable various devices to receive and send information from and to one another through shared data (De Saulles ,2017:1) In the 20<sup>th</sup> Century, there were enormous developments in technology with new models, and the IoT is one of the 4IR features. According to Karabegovi and Husak (2018:72), the internet plays a huge role in connecting different electronic devices such as computers, fridges, television sets, mobile devices, and many more electronic devices. Additionally, this digital interaction sharing information within machines and systems forms the heart of the 4IR and enables connection with other devices to perform properly.

As pointed out by Accenture (2015) the (IoT) is also well known as informative and communication technologies in order to connect people through a diversity of technological objects, not just computers or smartphones but even household appliances and motor vehicles. Moreover, it is predicted that by 2020 there will be 50 billion 'objects' connected to the Internet in order for people to more easily and quickly access information using technical gadgets.

#### **3.3.5. Three-dimensional (3D) Printing**

According to Eisenberg (2013:7) historically the patterns of growth in 3D printing are not different to those related to the growth of home computers which took place in the late 1970s. Chow-Miller (2018:9) notes that 3D printing is the practice of making solid 3D objects from a digital file. The advantage of 3D printing is that it presents a much faster and cheaper way to create objects. This new technology has been used extensively in various fields, including medicine (artificial organs using human cells) and as a result, the health system has been improved.

### 3.3.6. Quantum Computing

According to Microsoft (2019), quantum computing is faster in solving problems that require more time to be resolved. Quantum computing enables innovative discoveries in the areas of energy, healthcare, environmental systems, smart materials, and beyond. Correspondingly, IBM (2019) asserts that quantum computers are capable of promoting and developing breakthroughs in life-saving medicine, science, and machine learning techniques to diagnose illnesses quicker. With all the above mentioned 4IR components it is clear that society, government and corporates need faster and more innovative technologies to resolve social, health and economic crises. It is well noted that agriculture is broad and contribute a big contributor to the economy, and also provides employment to communities. Commercial and small-scale farmers will therefore benefit from the use of the 4IR technologies, and here is how:

**Table 2. The key emerging 4IR technologies in agriculture**

Emerging technology	Description
<b>Artificial intelligence</b>	It is a system recognising complex patterns, processing information, drawing conclusions and making decisions. System which may evolve in the future and which is autonomous in its reasoning/thinking and able to improve itself entirely independently from humans.
<b>Big Data analytics</b>	The use of Big Data for credit scoring farmers and the internet will enable irrigation systems and also remote telephone farming allowing farmers to capture more useful farming techniques. Farmers will be able to make a decision based on accurate information including accessing hidden patterns, market trends, and enabling customer preferences.
<b>Blockchains</b>	With blockchains food will be traceable using systems for international trade; including digital land registers of land titles of farmers making digital records of crop storage in warehouses available and secured. Computers will store the databases, networking, software, analytics, and intelligence about the fields over the internet ('the cloud') to be used by farmers when they need such data.
<b>Fifth-generation wireless (5G)</b>	Commercials and small-scale farmers can interact and make use of the latest technology for the connection of cellular digitals and increase the speed and responsiveness of wireless networks to connect with other agriculturalists.
<b>The Internet of Things (IoT)</b>	This system of interrelated computing devices will help mechanical and digital machines and also objects to transfer data over a network without requiring human-to-human or human-to-computer interaction and farmers can communicate via the IoT to capture more data about agricultural technologies.

<b>Autonomous vehicles</b>	Driverless vehicles (e.g. tractors) can be monitored by mobile devices and work double compared to humans and can also move and guide themselves without human input, increasing agricultural quality output.
<b>Drones</b>	They are unmanned flying vehicles that are controlled remotely. Drones are used to monitor crops and soil conditions and collect data about fields and plants, thereby assisting farmers to yield more agricultural output.
<b>3D</b>	Farmers will be saving time and money by purchasing fabricated agricultural machines and repairing items/parts to produce quality products in a shorter period of time.
<b>Robotics</b>	This is an industry related to engineering and construction. Even farms will use robots which are machines designed to perform more tasks automatically with speed and precision. As the 4IR implies, with increasing the production also robots machines will ease the agricultural activities.
<b>AI-Machine learning</b>	This will assist automatic plant management and spatial planning while analysing soil and weather conditions for precision farming and greater output.

**SOURCE:** Duckett, Pearson, Blackmore and Grieve. 2018.

The use of 4IR technologies is mainly to produce rapidly and provide for the growing population in the near future. Krall (2015) further indicates that 4IR practices will make small-scale and emerging farmers think and act entrepreneurially since their knowledge and skills in agriculture will be enhanced by the 4IR technologies. Sustainable farming requires a lot of knowledge; hence farmers, including small-scale farmers are expected to make optimal use of the available resources. According to Awosola & Scalkwyk (2006) in South Africa stakeholders and government have been working on improving relevant skills in different sectors, including providing farmers with more relevant agricultural knowledge.

Hobsbawn (1996) states that in addition to agriculture struggling with numerous challenges, SA as a country has the issue of load-shedding. The challenge of electricity is also affecting other African countries. This is a recurring issue and SA is still finding ways to improve its renewable energy power sources. The issue of 'load-shedding has tormented citizens because of the significance of electricity in operating most of the machines in businesses. It also affects people socially. The issue of electricity is worsening in rural areas and some of the farmers, both commercial and small-scale, are residing in remote areas. But communities themselves are often the perpetrators of this crisis because of stolen cables, and some households having

illegal connections. Additionally, sometimes the municipalities fail to pay the national power agency, Eskom (Wolfert, Verdouw & Bogaardt, 2017).

According to Morrison, Raju and Sinha (2007), the 4IR technologies require people to have sufficient Network and Information Learning base in order to fully participate and adapt to the transformation. For instance, In Ghana, farmers are interconnecting through social networks. This has influenced and provided better access to different information links and updates on agricultural techniques. Wier and Knight (2000) established that 88 per cent of the farmers using technology to enhance their communication in the exchange of agricultural information, were most likely to make positive agricultural decisions because they relate better when they are the same age, gender and region.

### **3.3.7. The Fourth Industrial Revolution: implications for different industries**

The 20<sup>th</sup> century introduced the Fourth Industrial Revolution (4IR) as a continuation of the 1<sup>st</sup>, 2<sup>nd</sup>, 3<sup>rd</sup> revolutions (Schwab, 2016:12). According to Erboz (2017:2), the 4IR is a collective term for technologies of value chain organisations which has as its purpose the creation of more digitised systems and network integration via smart systems and expansion of the connection throughout the different businesses. Moreover, the 4IR has integrated all fields and sectors spheres of life. Some of the 4IR technologies have introduced virtual worlds, smart cities, big data, the Internet of Things (IoT), and AI as the main new era development.

Schwab (2016:12) added that the fusion of innovative technologies and their interaction across the physical, digital, and biological domains have made the 4IR outshine the previous revolutions. As Schwab (2016:12) further points out, the 4IR is a new system that is threatening to replace the old working system of performing tasks with human labour by using more machines (robots). Erboz (2017:2) argues that the components of 4IR are categorised as the IoT, Cyber-Physical Systems, Artificial intelligence (AI), three-dimensional (3D) printing, robotics, blockchain technology, cryptocurrency, and quantum computing. According to Skilton and Hovsepian (2018: xxxiii), these technologies have changed the old ways of using materials and products,

and have increased services. Small-scale farmers are also producers of horticultural products, something which is critical for employment and income generation in SA, more especially in rural areas but also in peri-zones. DAFF, (2013) stated that in 2012 horticultural products contributed 25% to the total gross value of agricultural production, which also included the export of citrus (R7,9 billion), wine (R6,9 billion) apples, pears and quinces (R5,2 billion), and grapes (R4,6 billion), with most of these exports being from large-scale commercial producers. However, DAFF (2013) pointed out that integrating small-scale farmers to benefit and participate from export opportunities remains a challenge. The high speed of the internet connection has allowed direct interaction between citizens and government in order to improve the government services (Maharaj & Bernes 2015.) One may argue that one of the main contributing factors to challenges faced by society is the lack of technology. As a result, we see societies being affected by high unemployment, gender inequality, high rates of poverty, lack of education, and a deficiency of health services. Moreover, government developments have failed to provide proper platforms between global partnership and development in rural and urban areas.

The previous revolutions assisted agriculture and enhanced production, but they never threatened the existence of agricultural employees. People from rural areas have been working for the agricultural sector for years. However, the arrival of the 4IR has introduced powerful machines to perform farming duties. As a result, the farming chores require fewer people than before. Humans have been replaced by robotic agricultural machines such as drones, electronics, tractors and endless 4IR technologies. The powerful and advanced technological agriculture materials are a big factor in job losses in the farming sector. There is a therefore big concern and questioning of how well the government is prepared to ensure that small-scale farmers are also able to benefit from the 4IR.

The 4IR will threaten employees, even highly skilled individuals, as their jobs will become vulnerable in the near future because of business automation and the introduction of robots(AI). According to Schwab (2015) employees will be replaced by computerisation and machines in many working industries since robots have more potential to complete human tasks in less time and cost. This also questions the educational system globally, as the 4IR and other coming revolutions will demand

more skilful graduates ready to work with robots and expand their knowledge (Ford, 2015). One may argue that the 4IR will negatively impact median wages, and as a result income inequality will be worsened among societies.

Car manufacturers have decreased the number of employees because more work is done by robotic machines which are programmed to put together all different parts to the final product in large numbers and shorter time. Also, large agricultural sectors have benefited from using robots for different activities, such as harvesting and weeding and other tasks that have been performed by humans for many years. As a result, human labour loses its essentiality and this transformation intensifies the unemployment rate, more especial among communities in rural areas. The shift brought about by the features of the 4IR has its pros and cons and will impact people differently in the higher, middle and lower classes.

### **3.3.8. Importance of Agriculture in Developed Countries**

In developed countries, agriculture has contributed massively economically and changed significantly because of technological changes and progress. The implementation of new agricultural technologies in organisations such as farms and corporates has meant the adoption of new ways to increase production volumes, but it has also decreased employment as farmers depend more on machines, even though the same machines have brought a better quality of products and has decreased the environmental nuisance of agriculture. Most farm workers are jobless and with limited skills. Besides the increase in the effectiveness of management in agriculture, technological progress contributes to the reduction in the level of risk of management (Kim & Chavas, 2003).

According to Grant (2002), in Germany from 1880/4, 1893/7 and 1905/9 agricultural productivity from regional accounts for twenty-one regions increased. In East Elbia agricultural productivity was growing and met the German average. On the other hand, the productivity in the Southern region was steady, which proved that yield improvements were not limited to large farms and plantations. Furthermore, even smaller holdings had access to the innovative technology to improve farming methods. The developed countries were using precise agricultural systems which also brought productivity up in the rural east to a level equal to or above the national

average. This convergence mechanism was associated with the spread of more advanced agricultural techniques that aimed at developing and benefiting commercial and small-scale farmers. One may argue whether the developing countries considered this when adopting foreign farming techniques.

For Chang *et al* (2001) Asia and the Pacific have been focused on how to promote agricultural productivity growth and to achieve sustainable food security most efficiently. These countries used the role of investment, both in physical and human capital, for successfully sustaining and increasing agricultural productivity. The existence of humans has played a major role in developing the economy.

### **3.3.9. The Importance of Agriculture in Developed Countries**

Zepeda (2001) observed that agricultural investment and productivity in the context of developing countries are relatively weak in terms of physical capital and growth compared to developed countries investment in technology and human capital. Moreover, the other factors that affected growth were the policy environment, political stability, and natural resources degradation - issues which are faced by farmers. This case differs because commercial input is well established or supported by big machinery and adequate fertilizers. Chavas (2001) stated that the developing countries used technology in the early 1990s which was similar to the one used in the early 1960s, which showed that agricultural improvement also depends on other inputs such as fertilizer and pesticides rather than simply improved technology.

Chang *et al* (2001) found that the improvement in labour productivity in China was 0.68% per annum between 1961 and 1975, rising to 4.37% per annum from 1975 to 1987, but decreasing to 4.13% per annum from 1987 to 1994. Due to the growth in labour productivity, the agricultural productivity with the exception of Japan stayed positive from 1961 to 1994. The total factor productivity for China astonishingly remained negative despite its growth in output and because of productivity in labour and land. This was influenced by the output growth which was generated primarily from the expansion of inputs, rather than productivity increases. Tripathi & Prasad (2008), however, argued that an improvement consists of enhancing labour, capital and land productivity to influence agricultural productivity. The agricultural productivity

growth in India used all the three elements i.e. labour, capital and land to improve output from 1967-70 to 2005-06. Developing countries, including SA, can implement the same technique instead of focusing on technological advancement.

As a result, all the three elements produced mentioned above were used as an input and they brought positive output and had a significant influence on agricultural productivity growth. Moreover, because of the agricultural growth estimation that took place in the period 1970-1995, there was increasing agricultural employment and greatest impact on the output, followed by land, fertilizer and tractors. In general, public and private investment is required to increase agricultural production for both commercial and small-scale farmers (Velazco,2001).

### **3.3.10. Agricultural productivity in Africa and South Africa**

According to Conradie, Piesse, and Thirtle, (2010b) the rates of Market Facilitation Programme (MFP) growth in Africa are usually low compared with those for other countries globally. Ajao (2008) notes that within Africa itself the level of MFP differs, due to changes in agricultural productivity in Sub-Sahara Africa (SSA). There was a study conducted in Africa from 1961 through 2003 and the Data Envelopment Analysis (DEA) was used as a method to measure the Malmquist index of total factor productivity. The Total Factor Productivity (TFP) measures evaluated what the motive was behind the performance of factor productivity, whether it was due to technological or technical efficiency change. The effect of other variables (land quality, malaria, education, control of corruption and government effectiveness) were also examined. The focus of the study was mainly based on Burkina Faso, Cote d'Ivoire, Kenya and Djibouti, which were the four countries with the highest TFP growth. The study further revealed that Lesotho, Sierra-Leone and Swaziland had negative TFP growth, due to a decline in technical efficiency.

According to Van Zyl, (1993) the first TFP study in South Africa was conducted by Thirtle and Sartorius von Bach and the main focus was on the productivity of the commercial sector as data on small scale farmers was not available in the Census of Statistics Department. According to these authors, the TFP grew at an average rate of 1.3 per cent per annum from 1947-1991. This was due to a decline in the cost of labour

input as it was abundant and cheap at that time. In these years the tax concessions and credit policies made labour cheap and capital more expensive. This triggered productivity and, together with increasing employment, such changes led to the growth of improved social welfare. Following this study, Kirsten and Vink in 2003 evaluated TFP for the period between 1947-1996 and found that there was an average increase in the productivity of the sector due to increasing inputs and output. However, they further found that the TFP improved at a declining rate since in 1960 it was 2.05 whereas in 1996 it was 1.6. The reason for such variation was due to growth in the value of capital which made labour cheap, deregulation of markets and an increase in inflation rates which made inputs expensive especially for small-scale farmers.

Another study, conducted by Thirtle, Piesse and Gouse in 2005, which updated the study of Thirtle, Helmke Sartorius von Bach and Van Zyl (1993), corresponded with the findings of Kirsten and Vink (2003). The results of their study presented the fact that between 1993 and 1999 the TFP had been fluctuating. In 2009 Conradie, Piesse and Thirtle compared the level of amassing statistics for calculating productivity at district, regional and national levels using data from Western Cape Province for the years to validate the unsteady in the agricultural sector in the period 1952-2002.

### **3.3.11. How will South African agriculture benefit from the use of 4IR?**

According to Groenewald (2018), the 4IR will bring positive changes in agriculture through the value chain and the agro-processing chain. Also, the agricultural processes will be enhanced, increasing productivity and reducing costs. The 4IR will also benefit South Africa and create opportunities for agri-processing development. Some of the most recent agricultural developments are transforming and using smart farming tools. A great outcome has been experienced in the form of improved crop yields, and reduced water consumption and greenhouse gas emissions.

According to Beegle, Luc, Andrew and Isis (2016), rural areas in Africa remain much poorer than urban areas. The World Bank (2016) found that, worldwide, 80% of poor people live in rural areas, 64% work in agriculture and 44% are 14 years old or younger which shows that child labour in developing countries still exists. The developing countries confirm a strong linkage between agricultural growth and poverty reduction among small-scale farmers by employing people to work in agriculture sectors while

using advanced technologies (Djurfeldt 2013). Agriculture has the potential to stimulate growth in Africa, and that growth would be twice as effective in reducing poverty with the help of the 4IR (African Development Bank (AfDB) (2010). Agriculture has contributed to the alleviation of urban poverty, offering an alternative to migration to urban shantytowns and increased food security in rural areas. Kautsky (1899) found that younger peasants were encouraged to migrate and engage in non-agricultural forms of livelihood because of the declining employment in the agricultural sectors. This was triggered by the introduction of agricultural machinery.

Cronjé (2016) and Rossi (2015) rightly observe that the growth of digital technology has brought disruption to different sectors and change for the entire system, including production, management and governance of every industry since the 1990s. However, TRALAC (2016) added that there will be skills instability, because of the rapid change in the skills requirements of all existing jobs in small and large sectors, and the fluctuation of employment will also impact countries differently. As Rossi (2015) put it, the advancement of technology will be propelling our society forward. There is a lack of investment in human capital because companies are more focused on hiring the best whereas, empowering the company's workforce is essential, particularly women and those in local markets. The capability theory by Sen (1980) supports the above statement on allowing people as an individual to contribute to the GDP by sharing their skills in businesses.

However, as TRALAC (2016) states, one of the major barriers to 4IR technologies and transformation is the lack of identified specificity on the types of disruptive change underway for big and small industries. As a result, developing countries are uncertain because of unforeseen challenges and this leaves them more vulnerable. Moreover, some of the management fails to take responsibility for upskilling, reskilling and collaborating rather than focusing on employees competing on talent. According to Capability theory, (Sen, 1980), agricultural employment improves and supports the enhancement of individual skills, in the same way, that small-scale farmers are capable of developing their sector by adapting to the technology. As NEPAD (2013) put it, agricultural growth in Africa is through employing a larger labour force. Larson, Otsuka, Matsumoto, & Kilic (2014) emphasise that the keys to productivity growth for

African countries have been affected by the lack of support for small-scale farmers to adapt to the new technologies to boost their yields.

As pointed out by Strange & Baley, (2008) development is a process of growth to meet the present generation without compromising or affecting the future generation meeting their own needs. In that manner, the development of technology has so many unanswered questions with regard to the adaption of technological tools affordance and sustainable agricultural development considering local diversity (small-scale farmers). According to Francis (1990), agriculture and rural development have not been treated as local concerns to improve and empower small businesses. Again, Stevens & Terblanche (2004) state that small-scale farmers lack efficient ways of communicating, transmitting and sharing agricultural information by using mobile devices compared to their commercial counterparts. The use of mobile devices also allows farmers' capacity to interact effectively and efficiently with local people based on their agricultural needs. The modernisation of agricultural equipment has provided a range of different options for collecting and analysing process data and farmers have gained so much knowledge from using technology. However, not everyone has digital agricultural equipment, more especially small-scale farmers, who are challenged by financial constraints. As much as the potential of digitisation and using data for agriculture is generally recognised small-scale farmers are still behind and struggle to access adequate technology (De Wilde, 2016).

According to the WEF (2017), although the 4IR technologies such as artificial intelligence and robotics will improve and enhance the old working techniques, they may also destroy or disrupt many jobs in the services sector and labour-intensive industries. According to Baiyegunhi and Fraser (2014), the procedures followed when applying for credit focuses on the age of the farmer (small-scale farmer), as well as educational level. But as Baiyegunhi and Fraser (2014) go on to explain, in the Eastern Cape of South Africa, small-scale farmers average schooling is 8 years, while the requirement for small-scale farmers to access loans is at least 10 years of education. This has led to small-scale farmers not qualifying to access loans to enhance their

productivity. The insurance firms and credit providers isolate small-scale farmers because they pose a covariant risk due to factors like moral hazard and anti-selection.

As pointed out by Baiyegunhi and Fraser (2014), the main suppliers of credit are commercial banks, and these commercial banks prefer clients who can offer collateral in the form of property, and also clients that can produce proof of employment in the form of a payslip. This has prevented small-scale farmers from accessing loans for the past decades and as much as the 4IR technologies focus on development, small-scale farmers are struggling to have any form of income besides farming turnovers. As much as productivity growth has increased over the years, small-scale farmers are behind with the transformation taking place in agriculture (Jorgenson, Gollop, & Fraumeni, 2014). Agricultural output has been influenced by technical efficiency and technological progress, and in that way, the inputs have increased to produce outstanding output (Asekenye, Bravo-Ureta, Mukherjee, Okoko, Okello, Kidula, & Puppala, 2013). In support of the above statement, Smith (1776) notes that in classical theory, the effectiveness and efficiency of agricultural output being established.

As Mhango (2016) points out, the gap between poor and rich countries is widening and there is insufficient investment in research and development on small businesses, including small-scale farmers. Again, Treanor (2016) and Mahlakoana (2016) emphasise the lack of policymakers' intervention in tackling the widening inequality between big and small businesses. One may argue that the developments of revolutions are pushing away illiterate people with less relevant skills from corporates and employing robots to make more profit and are advancing developing countries are competing amongst each other. On the other side, the agricultural sectors have already been provided with some of the solutions to drought and produce quality outcomes, but the alternatives work best for commercial farmers.

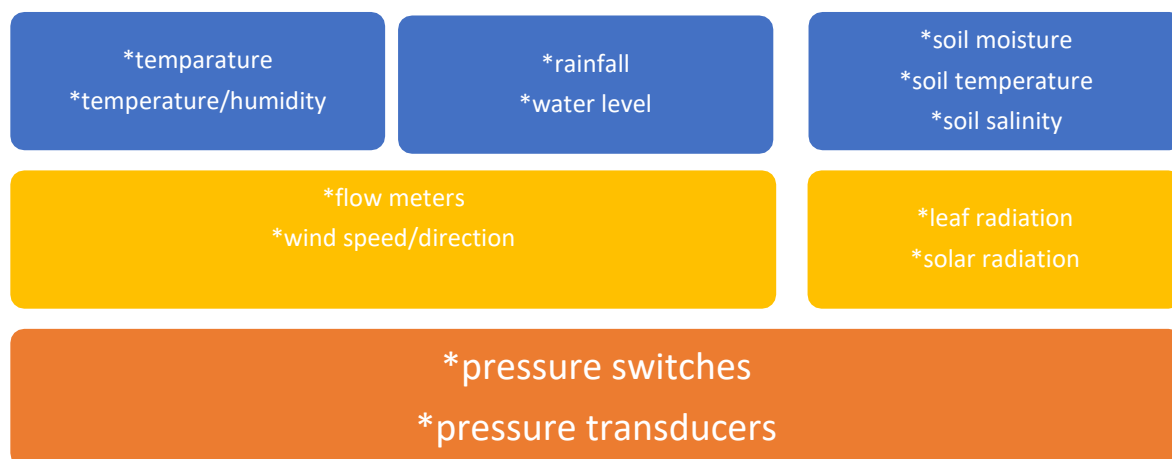


Figure 1:Source: Davis Instruments (2019)

### 3.3.12. Figure 1: The use of 4IR technologies to Increase Farm Productivity under Conditions of Climate Change

The Davis instruments are used as a tool to eliminate input and output wastage which is also one of the agricultural challenges. Aggarwal (2016) notes that the trends of weather have been extreme since 1960. As a result, droughts have contributed to short-term floods, greater coefficients of variation, heat events, multiple weather-related risks and more variable rainfalls. According to Liebenberg et al (2010), over the past years, the productivity of field crops has been fluctuating due to rainfall variation and recurring droughts which affect the output and quality of product. Even though agriculturists have experienced declining yields in the twenty-first century, have benefited from the grain harvests, due to increased mechanisation and the use of improved seeds, fertilizer, herbicides and pesticides.

In the period 2004-2010, the levels of state yields of wheat and rice showed the possibility of how much higher rice and wheat yields might have been, with required inputs being available during different seasons (Aggarwal, 2016). Most developing countries have failed to obtain greater investment in research to develop multi-resistant crops, including small-scale farmers. According to Mahul & Stutle (2010:19), there are contributing factors to insufficient agricultural output, such as natural disasters and drought that have led to shareholders hesitating from investing in the agricultural sector activities and its growth.

Ehui, (2018) found that larger private sector investments are focused mainly on crops with high export potentials (commercial). As IEG, (2011) points out, African countries are excessively affected by the impact of climate change. The prospective water and irrigation investments are one of the agricultural challenges. Shaban, (2017) argues that Africa has 65% of the world's uncultivated arable land and a great quantity of freshwater. Additionally, the percentage of Africa's working population engaged in agriculture is estimated to be 60%, and the soil across the continent is rich and fertile. The Central Bank of Nigeria (CBN, 2000 and CBN, 2003) stressed the other factors influencing agricultural production is less than it should be. There is inadequate working capital, contributing to the low rate of adoption of appropriate agricultural technologies. Crops are affected by diseases and pest infestation because of poor post-harvest technology availability. Additionally, small-scale farmers struggle to accumulate adequate capital and sustain their farms.

According to Perry and Steduto (2017) farmers have not fully prioritised the important initiative of quantification of the relationship between rainfall and groundwater levels. The World Bank's Independent Evaluation Group (IEG) note that the speed of mobile technology has left behind other basic infrastructure such as ways of eliminating drought, inadequate electricity, water, and roads, inhibiting digital dividends. The IAASTD (2015) added that the soil, water, plant and animal diversity, climate and ecosystem services are critical for agriculture and they are essential natural resources. The issue is that in South Africa only 12% of the land has fertile soil, which prevents farmers to expand their farming fields. Albeit it that agriculture sectors are challenged by natural disasters, at some point farming practices such as overuse of fertilizer, irrigation, and poorly managed tillage led to erosion, and the creation of acidic or salty soils leading to the soil being less fertile and less absorbent. Additionally, more than 5 million hectares in SA are already affected by soil degradation (Goldblatt, 2011). Generally, agricultural development concentrates on increasing productivity and paying lesser attention to the impacts of agriculture on the environment. The thrust of the 4IR is mainly on improving production and feeding the growing population, not looking into the impact it may have on the environment.

As a result, there is overwhelming confirmation of the negative impacts of modern agriculture on the environment and the cost of the provisioning of ecosystem services. Barras (1983) indicated that the quality improvements inspired some expansion of markets and enhanced products for business. Quality improvement may also influence corporate broadening, even integration, among the service providers. Likewise, the 4IR technologies may be costly for small-scale farmers. For instance, the thought of introducing 4IR technologies into developing countries' markets is impossible, because their local markets are not big enough to absorb (small-scale and commercial farmers) agricultural output locally and, as a result, there would be a reduction in the prices, which in turn discourages small-scale farmers from expanding their output (Watkin, 2003).

Eboh, Ujah, and Nzeh, (2010) reported that the Federal Government of Nigeria, (2004) identified the following major constraints preventing the improvement of agricultural production in Nigeria and these challenges are not limited to other African countries such as; South Africa. There is a high rate of people rapidly shifting from rural to urban; the shift from the consumption of local to imported food items contributes to the lack of funds; input supply and distribution; inadequate processing and storage facilities; the oil boom. Meanwhile, policy inconsistency and declining political commitment to agricultural sectors continue.

### **3.3.13. Embracing the 4IR while securing jobs in different sectors**

Farmers have adopted new technologies which reduce individual costs while increasing productivity. New technologies (4IR) affects the transfer of aggregate supply, decreasing price (Barrett, Carter, Timmer, 2010; Cochrane, 1958; Gardner, Hardaker, Anderson, (1984). However, the rising issue is that the adoption of massive agricultural technologies generates unemployment. The modernisation of agriculture, is also a greater threat to the natural environment, including lowering the quality of food products and increasing social costs of production (Batie, 1989). Human eyes are no longer capable of dictating what drones are capable of, and these days most decision-making made by small-scale farmers concerning field issues need more advanced and scientific resolution including technology for quality output and food

security. Yet, the small plot will not necessarily need or even benefit that much from the use of drones because the fields are small enough to be manageable. Lately, researchers have focused more on the developed-world lens, paying less attention to the farming techniques that have been used by small-scale farmers throughout the past years.

The use of drone technology is not limited to agriculture, as it is quickly becoming one of the most beneficial because they are equipped with thermal and infrared imaging technologies which are progressively functioning and relaying data autonomously. Small-scale farmers have been able to perform agricultural activities by hand and one may use such strength they have to build from what they have been previously depending on to enhance those skills and knowledge before introducing the 4IR. As Smith (1776) says, in classical /political theory, the increase of exports benefits both commercial and small-scale farmers. Even though small-scale farmers try to produce products based on their capability one may argue that it is not enough; their existence needs more government assistance to be recognised abroad.

According to Gray (2016), approximately 35% of skills that are considered important in today's workforce will change in the near future. Therefore, new sets of skills will be required for the 4IR and the use of new technologies. For example, sales employees and people in manufacturing will need more literacy skills (Gray 2016). As the 4IR technologies create new jobs and improve production there will be job displacements (Nordin and Norman 2018:1). Hooker and Kim (2019:7) argue that new 4IR technologies could displace workers in larger numbers than have ever been seen before.

According to Leswing (2017), 4IR technologies have been used by many businesses and most sectors are happy with the product, but small businesses are not utilising the advanced technologies as much as the big corporates. Low skill and low wage jobs are likely to be replaced by computers and digitisation in big corporations. Of course, the higher paid jobs are still in demand, and the more skilled people are less likely to be replaced by machines, depending on the nature of duties (Wolf 2015, 125). As automation substitutes labour across the entire globe, machines might exacerbate the gap between returns to per capita and unemployment. In the future, certain talents will

be in greater demand than qualifications. Specialist scientists are expanding ways of increasing production using advanced technologies instead of human involvement (Brynjolfsson, McAfee, and Spence 2014).

### **3.3.14. Challenges faced by small-scale farmers**

#### **3.3.14.1. Dual Economy**

There is a need to revisit the South African agricultural sector and its historical context. The policies that were implemented during the apartheid era generated an environment where most small-scale African farmers were excluded from fully participating in agriculture. The same policies also contributed to small-scale farmers being denied ownership of land, as well as access to finance, information and markets. The same policies and technologies promoted the importance of commercial farmers increasing productivity and the implementation of that resulted in labour reduction and losses of jobs. The agricultural challenges have existed over the past decades and the innovation have not yet resolved the challenges such as agricultural dualism. The minority of white commercial farmers are still more active in national food security and therefore remain important to South African agriculture development compared to small-scale farmers (Thirtle et al., 2000; Metelerkamp, 2013). South Africa's agriculture sectors have experienced substantial policy reform since the dawn of democracy in 1994. Now 26 years later, it is an appropriate time to look back at this period to evaluate key successes and failures. DAFF (2012) submits that agriculture sector outputs in South Africa are impacted by climate change and also other challenges threatening people's lives, more especially the ones that are vulnerable to food insecurity.

Lipton (1977) observed that the dualism had resulted in a separate development, geographically, economically, and socially. The early post-Apartheid agriculture and land reform policy were inevitably aimed at addressing this dualism, but unfortunately, such accomplishment has not been attained by many developing countries (Karaan and Vink, 2014). Also, their distribution of farms is around 7,3% units, accounting for about 50% of collective gross farm income and 60% of net farm income in 2007 (Stats SA, 2007).

#### **3.3.15.2 Unsustainable farming practices**

Dube, Chiduzza & Muchaonyerwa (2012) contend that in SA the soil used by farmers is losing health as a result lacks the full capacity to produce quality output. Farming practices contribute to the environmental productivity and richness of the soil. Consequently, in most rural farming communities allow livestock to feed on crop residues, especially in winter, without proper management. In South Africa, the soil degradation has been described to be most severe in communal croplands and grazing lands, and even though small-scale farmers general utilise low levels of input they also lack the knowledge on how to take care of the soil (Meadows and Hoffmann 2002). According to Lipton (1968), the peasant farmers lack requisite information, and the rainfall is insufficient.

#### **3.3.15. Climate change**

Global warming is a major environmental challenge facing farmers but actually includes all of humanity today too. Over the past years, it is one of the major causes of reduced agricultural productivity, and many parts of rural places in South Africa are disrupted by climate change. Other African countries have also experienced this challenge contributing to low agricultural productivity/production such as in Sub-Saharan Africa (Barrios, Ouattara & Strobl, 2008). In South Africa, generally, most crop farming depends on the rainfall to grow (Kurukulasuriya & Rosenthal, 2003). In 2006 South Africa needed to import 7 million tons of maize, roughly half of its total requirements because of drought. The drought also impacted customers and resulted in high food prices. Moreover, there was the added threat of severe food shortages, an experience which was felt mostly by rural households in poor communities that usually buy in bulk because of big families.

#### **3.3.16. Poor infrastructure and logistics**

According to Oelofse and Nahman 2013, and Nahman & de Lange (2013) there is evidence that between 30% and 50% of all food produced for human consumption is being lost from pre- to post-harvest. Yet, a lot of food is wasted along the food supply chain from production on farms to consumption at the household level. Not only does this have a negative impact on food security, but it results in huge quantities of resources embedded in food production becoming wasted. Small-scale farmers

particularly are struggling to keep the product at post-harvest and storage. Some of the products require quality store rooms such as vegetables under the correct temperature. Moreover, the wrong packaging of the final product contributes to small-scale farmers producing less for the market. The issue of poor infrastructure is the most serious downfall facing agricultural development and delaying the success of the agricultural sector, especially small-scale farmers. Based on the challenges at hand and a poor rural road network, small-scale farmers are highly dependent on inefficient forms of transportation. In rural areas, they still rely more on the practice of using animals to transport the end product to the nearest centres for collection. Additionally, electricity is expensive for people in rural places and some places is often not available. As a result, they cannot afford or sustain cold storage facilities. The classical/political theory by Smith (1776) denotes that the wealth of a nation comes from individuals as they participate in contributing to the economy. Hence, the challenges faced by small-scale farmers are due to massive policy development, while failing to capture data on small-scale farmers and resolving issues at their level.

### **3.3.17. Poor Education of small-scale farmers**

Agriculture is viewed as a great tool for eliminating poverty and unemployment (Department of Agriculture, Forestry and Fishery, DAFF (2011). However, as much as small-scale farmers are participating and willing to expand their output the truth remains that most of them are illiterate and ageing. Even though development has dealt with many of the social crises, especially challenges faced by black people, there is a tremendous gap in education between black people compared to other races globally. Most of the people in rural areas, depend on agriculture activities and gain a lot from the practice of agriculture (Organisation for Economic Co-operation and Development (OECD,2006). However, the lack of skills and knowledge is not the major issue but the absence of youth participating in agriculture to assist the older farmers on how to properly use technology in the 21<sup>st</sup> Century is a serious issue. Internationally, food security and sustainable agricultural production have been enhanced and promoted at levels with adequate education and training, which most of the developing countries are lacking (Olubode-Awusola &Van Schalkwyk, 2006).

Lower levels of education and skills in rural areas disempower agricultural farmers and workers, and as a result, this has impacted on their capacity to easily adopt emerging technologies. Although funding for education increases yearly, it is still not adequate for the full functioning of educational institutions and also their adoption of advanced technological practices and advanced educational activities. The biggest cost for the establishment of training in Africa is related to qualified teachers and technological infrastructure to improve local technologies to make the budget a reality (Brown-Martin 2017:9).

Badat (2010:30) argues that even though black student enrolments have improved since 1994, the African and coloured gross participation rate of black people, especially of South Africans, remains considerably lower than for Whites. Universities have tried to address the issue of social justice by creating equitable conditions to improve the lives of the disadvantaged, but the educational system in SA has not reached its full potential (Chetty and Pather 2015:2). Universities have been promoting an environment of innovation and creativity for students. Providently, the 4IR will provide opportunities for South African education institutions by creating an environment of creativity and innovation for the next generation while the present generation still struggles with providing effective and sufficient quality education. The 4IR technologies require more specialists in science, technology, engineering, and mathematics (STEM) but the curriculum in SA has been questioned on whether the system can accommodate all the 4IR technologies and run smoothly.

Educational responses to the 4IR necessitate the restructuring of institutions to provide new interdisciplinary science programmes. A high-quality educational foundation for students and the practice of 4IR technologies will be shared among young and older farmers (Penprase 2018:219). As pointed out by Penprase (2018:221) in terms of teaching and learning, online instruction and the expanding usage of AI is necessitating new guidelines and the provision of a theoretical base for digital pedagogy. It is a basic prerequisite for students to develop adaptive capabilities in order to participate in the global digital society using digital literacy. Students will benefit from the digital economy, and also be exposed to more new opportunities for

employment, innovative business ideas, creative expression, and social inclusion (Brown-Martin 2017:7).

### **3.3.18. Limited access to production input and equipment**

Most small-scale farmers experience trials when it comes to accessing agricultural input to cultivate their farms. Small-scale farmers do not have access to quality fertilisers, implementation and machines such as tractors. The lack of access to such equipment often results in poor selection in terms of quality seeding, cultivation, type and quantity of fertilizer to be applied and when. Impressively, on the other hand, the 4IR technologies and AgriTech will increase people's health and food security, because the farmers will have verified information on the requested fertilisers and will have more working equipment (De Wilde, 2016). Small-scale farmers in Uganda have taken the opportunity to use drones in the Technical Centre for Agricultural and Rural Co-operation CTA's Eyes in the Sky project at the Igara Tea Factory (Naude, 2017). As a result, farmers are able to calculate yields and the type of seeds and fertilisers needed for different seasons. Over 4,000 digitalised profiles of small-scale farmers have been created (Naudé, 2017). According to the FAO and ITU (2018), the IoT and the use of drones in agriculture are reducing production costs and increasing product quality.

AU and NEPAD (2018) added that the use of drones also has a major application for more accurate farming, as they give more details on fertiliser application and location-specific nitrogen with the correct fertiliser dosage recommendations through prescription map generation. Moreover, they help with planning irrigation schedules and precision spraying, contributing to precise and effective farm management systems. Although small-scale farmers produce less compared to commercial farmers they can use some of the technologies and knowledge to yield more. Sen (1980) also proclaims that the capability approach theory searches for the ability in a person. As a result, is important for the government to look for these things when introducing the 4IR to small-scale farmers the capability to purchase new agricultural technologies and the willingness to abide by the change.

### **3.3.19. Access to markets and credit**

According to Hall & Aliber (2010), there has been ignorance from government and stakeholders on the importance of small-scale farmers accessing proper and markets value chains. The input and output from markets is a key precondition in order to transform the agricultural sectors from small-scale to commercial farmers' products. Notwithstanding these challenges, some small-scale farmers continue to produce food from their own capital (Ortmann & King 2006). However, small-scale farmers are lacking cold rooms, pack houses, full traceability and food product soil and water analysis that come at a great expense. The reality is that all this is scarcely affordable by some commercial farmers let alone emerging farmers who lack capital. According to Hoff and Stiglitz, (1990); and Bell, (1990); Doss (2001) small-scale farmers struggle to access credit, as their capability to repay the loan depends only on their turnover. The type and size of the land influence the entire procedure and process of being granted a loan, a result which is often unsuccessful. The implementation of the Agricultural Products Act of 1996 has made agriculture to be dual resulting in commercial and small-scale farmers with a lot of inequality among commercial and small-scale farmers (Mudhara, 2010).

Siyao (2012) found that the use of relevant and effective information to develop agriculture through communication results in innovative agricultural techniques. Masuki et al. (2010) state that accessing agricultural information from other farmers and the internet is another way of assisting small-scale farmers, by advancing their production capacity even accessing higher remunerative markets and supply chains. IFAD (2012) reports that even though rural communities and farmers are in need of basic education on various and easy farming ways, they can use the available technologies to communicate better. While at the same time improving their agricultural skills. The knowledge and skills is based on what they are used too. Agriculture is a vital sector, which is why the schools and universities are teaching about agriculture, in order to give more insight about farming, moreover, learning more about the importance of food security and nutrition, and also adapting to technological agricultural practices that hold the future of the next generation. Additionally, the future of agriculture will be sustained to prepare a solid foundation for knowledgeable young farmers, while also being compatible with community development and agricultural initiatives

### **3.3.20. Land reform issues**

In SA government launched its land reforms in 1994, in the form of restitution and redistribution programmes aimed at improving people's lives, more especially for the ones who were disadvantaged before. Also, Tenure reform addressed the necessity of giving back the land to people or providing equivalent payment to those who were forced to leave their land through apartheid laws after 1913 (Hewitt 2016). The main objective of land redistribution is to rectify racial imbalances in land ownership and allow agricultural sectors to grow and expand, more particularly small-scale and emerging farmers.

According to Newling (2011), the issue is how the process of Land restitution has been tackled by many developing countries because some countries depend on the land contributing to economic growth. The truth is that land ownership empowers and financially support the owners of socio-economic survival in developing countries (Hewitt 2016). The agricultural policies were well established in South Africa after 1994, and they were fully developed to accommodate commercial and small-scale farmers to enhance the agricultural output. However, as Senyolo (2007) affirms, as much as government institutions such as the Department of Agriculture, the Land Bank and the Agricultural Research Council have tried to help farmers' small-scale farmers and their activities have been given slight attention.

According to RSA, (2010a); Lahiff & Cousins (2005) whites own 87% per cent of the land and 13% per cent was owned by black people. Even though the land is an essential resource for agricultural improvement, commercial farmers have more access to land. Beinart & Delius (2018) submit that regardless of the government's implementation of market-led land reform, white domination of land continues. Profoundly, land redistribution, through the 'willing seller, the willing buyer, have proven to be ineffective due to insufficient financial distribution to the land sectors and also, the non-involvement of alternative support systems from stakeholders and non-state agencies and other institutions to elevate the farming industry (Lahiff, 2007).

Conversely, Makhosazane Sambo from Mpumalanga started farming in 1996 and have worked together with a group of green-fingered women to supply fresh vegetables to local supermarkets such as Shoprite. Their business is also well known in Johannesburg and Durban. In 2010 the co-op was formally registered and as a result, they are able to access government funding. In South Africa, small-scale farmers are not producing much as they end up selling to communities, not supermarkets (Masiwa, 2020). Moreover, these women co-exist as the Ikhwezi Vegetable and Poultry Cooperative, privately owned by a group of five farmers who were only farming to provide for their families. Their passion grew, and today they produce spinach, chickpeas, beetroot, onions, tomatoes, green beans, butternuts, bitter melon, sugar beans, watermelon and much more. As Masiwa (2020) notes, Ikhwezi has expanded their services and now also provide coaching and mentorship to local and emerging small-scale farmers.

### **3.3.21. Food and Trade**

The production of food is the primary business of the agricultural sector, and some argue that is vital for the country to be self-sufficient when it comes to food supply and food security. South Africa, pre-1994, was given its development agenda of import substitution and self-sufficiency of the agricultural sectors. Certainly, there was a decline in the field crop sector, and as a result, it is doubtful that the country is still food self-sufficient. Even though Statistics South Africa (Stats SA, 2012) showed that in 2010/11 the average household spend is more than 70% of its food budget on four main food groups, namely meat 25%, bread and cereals 26%, milk, cheese and eggs (MCE), 9% and vegetables 10%.

### **3.3.22. Employment**

In 2014 the stats showed that employment in the agricultural sector reached its highest level of just over 1.9 million throughout the early 1960s, but declined thereafter to just above 0.8 million in 2005/06. This trend of employment in agriculture decline has continued, with the total estimated at 0.74 million in 2013 (Stats SA, 2014). According to Van Zyl, Vink, and Fenyes (1987), the pre-1970 period is well recognised by a rise in agricultural employment. During this period, farmers mostly relied on employing more people for agricultural activities such as harvesting maize by hand. The South

African the economy during the 1970s started to experience labour shortages that put upward pressure on wages, particularly in the agriculture sector and mining. In that manner, the favourable real interest rates, together with moderate agricultural credits and tax incentives on capital items affected the relative cost of capital to labour. This contributed to farmers gaining greater 'control' over advanced harvesting processes and this eliminated the chances of people being employed.

### **3.3.23. Why harnessing agriculture and 4IR in Africa in general and South Africa in particular is imperative nowadays**

Africa has experienced a higher growth rate than other continents. The growth of the population is projected to double by 2050, from 1.2 billion to more than 2 billion people, which puts pressure on agricultural production (Dupoux & Zrikem, 2016). Feeding a growing population demands a threefold increase in African agriculture production by 2050 and for the next millennium. Africa, however, is struggling to be self-sustainable and improve food exports. As Smith (1779) observed, in the classical /political theory it is important to question and review whether a country benefits from tariffs and the trade market. As a result, this propels the country to do better in areas where it is lacking. In the case of food sustainability, even though people are buying food from retailers, some prefer to have small gardens on their pavement (vegetables, cabbage and tomatoes, onions, spinach) to save money and promote sustainability.

Recent literature on the 4IR by Schwab (2016) and others, explores how rapidly scientific discoveries at large are reshaping economies and societies, and whether government policies and interventions are keeping up with the rapid pace of technology. Potentially, the speed and range of technological change hold promise for accelerating inclusive agriculture and rural development, leading to more rapid structural transformation, from agriculture to high productivity manufacturing and other sectors. For instance, the implementation of IoT technologies is anticipated to enhance irrigation and crop protection by providing farmers with temperature data to help with more choices about ploughing and harvesting. There are also alerts on alternative water when primary sources become depleted as the human eye may not discover and pay attention to such details without extensive use of technology OECD (2015).

Small-scale farmers have been struggling to run their farming fields due to the lack of infrastructure such as dams to store water (OECD,2015). Agriculture employs full-time and casual workers, mostly females. Commercial and small-scale farmers are still dependent on manual labour, including vegetable planting, weeding and harvesting. The final agricultural product is sold to local consumers and street vendors. The use of the 4IR will improve the output, and also expand the farming fields. Ehui, (2018) states that the 4IR technologies will improve the lives of small-scale farmers, by offering them real-time access to market information. Naude, (2017) emphasises that the use of 3D printing will reduce the waiting time for farmers to obtain costly agricultural objects (Ramalingam, Hernandez, Martin, & Faith, 2016).

As Ojo (1994) asserts, in agriculture in African countries such as Nigeria the farmers are experiencing over-valued currency due to inappropriate pricing policies. In India agriculture's share of GDP dropped from 42 per cent in 1970 to 17.5 per cent in 2015; while nearly half of India's population depend on low-productivity agriculture, while also experiencing the fact that most of the poverty in the country is in rural areas (Woetzel, Madgavkar, Ellingrud, Labaye, Devillard, Kutcher, Manyika, Dobbs and Krishnan, 2015). The youth is not interested in agricultural jobs, because of low farm production, while they have higher aspirations.

According to the FAO, (2015, 2017) most small-scale farmers are lacking information on the value chain and also forecasts of weather conditions. The 4IR technologies have more information and practical knowledge to be used by small-scale farmers to enhance their skills and knowledge. GOI, (2017b) found that mobile technology enables secure banking transfers, and also improves the quality of service delivery. As much as the technology is well known by most people, the computer literacy of the poor must not be ignored. Small-scale farmers using phones to communicate on agricultural activities such as the availability of fertilizer at local retail outlets is essential.

### **3.3.24. Government fiscal support in the agricultural sector and the budget for 2020**

In 2020 an amount of R495.1 million was allocated by the government to the Department of Agriculture, Land Reform and Rural Development to develop compliance with support exports and biosecurity. Within the same year, there was an additional R500 million reprioritised over the medium term for the department to finalise land claims. According to Kirsten *et al* (2003) government, support for farmers has been massive, with debt consolidation subsidies of R344 million, crop production loans of R470 million, and drought relief of R120 million. The government also acted as a guarantor of consolidated debt of R900 million left over from the eighties and early nineties. All this was done to increase the productivity of farmers and sustain the agricultural sector. The minister of Agriculture took the initiative to increase the funds. As Smith (1776) proclaims, in classical theory that individual contribution is important to increase the economy. Although small-scale farmers have not reached their full potential in participating in export, they have made a huge impact in increasing employment.

Agriculture is an enormous sector that is expected to provide and deliver the best quality of the outcome. This includes both commercial and small-scale farmers. More than 55,000 farmers applied for financial assistance through the R1,2 billion Covid-19 Agricultural Disaster Support Fund in 2020, which was mainly for farmers. Of those 55,000 who requested financial assistance, only 15,000 were successful. Ashraf (2020) found that due to the coronavirus outbreak thousands of seasonal farmworkers in the Western Cape were laid off. Furthermore, most of the farmers are affected because of this pandemic and also will struggle to provide for their families as they depend on agricultural jobs. The Department of Agriculture planned to assist farmers during this time but were not specific to who will benefit from the funds allocated to farmers. The truth behind this was that 88 per cent of VAT-registered farmers (35,588) and the 230,000 commercial enterprises that fall outside the SA Revenue Services (SARS) are the ones who are qualified to register for financial support during the pandemic (Kirsten & Sihlobo, 2020.)

Right before the coronavirus outbreak, farmworkers and dwellers were protesting, demanding to work. Farmers decided to protest, holding up signs written “We shall not

be moved “. Apart from fighting for their jobs they also felt that their rights to work every day were violated. The protest took place outside the offices of the South African Human Rights Commission (SAHRC) where they expressed their frustration. For Kirsten & Sihlobo (2020.) this epidemic has negatively impacted agricultural exports, nothing was allowed to enter the country it is safe to do so. Thoko Didiza announcement brought hope for farmers that the department have R1.2 billion to support small-scale farmers. One may argue how will they define the needy small-scale farmers and in what terms, to assist those needy small-scale farmers because all the funds allocated for agriculture have to be returned for future use.

SA's annual agriculture contribution to the GDP is R95 billion, subsidised by wine production (Kirsten & Sihlobo ,2020). Due to the lockdown, the collapse of tourism has impacted wine consumption severely. Exports and domestic sales have experienced price drops, and farm profitability is not excluded from such drastic changes. Because of the closure of restaurants, the livestock sector has also have experienced an income decline during the lockdown. Additionally, field crops such as; maize, wheat, oilseed and sugar cane which contributes 23 per cent to SA farm income have been affected by the Covid -19 pandemic. Small-scale farmers' production/output lacks alternatives of good practices during input procedures, and so one needs to learn that it is important to understand and have knowledge on different crops and seasonal produce. With so much knowledge and skills, the 4IR will then assist farmers to improve their output when they know what they are lacking and change their practice for the better.

### **3.3.25. Creating an environment for small-scale farmers**

10,000 years ago the population worldwide was estimated to be roughly 10 million people internationally, this put a strain on agricultural practices which are challenged by drought and other related threats (Cipolla,1979). Small-scale farmers started from 1800 to present industrialisation initiated labour, often presented as peasant labour. The technological breakthroughs in attempts to control famine and disease originating from industrial societies trickled over into the largely agrarian continents, namely, Asia, Africa and Latin America, resulting in population growth rates in peasant societies to

increase (Cipolla, 1979). On the other hand, industrialised countries ended up seeking sources of raw materials and markets, and colonised many parts of the agrarian world. The small-scale farmer's intentions were not based on making a profit, but to produce food for family members. This was understandable because the labour was not paid. Even though this act was genuine, it contributed to labour waste and led to poor organisation, inefficient tasks and poor transport conditions. As Chambers (1983) found, in actual fact, development in agriculture is more multi-disciplinarily in combining agriculture economics with technical fields, namely civil engineering and agronomy rather than representative development economics and more especially socially-based peasant studies. As a result, the approach has been criticised for its inattentiveness to small-scale farmers' perspectives with its top-down orientation to the transfer of technology in order to improve the agricultural output.

First and foremost, according to Cipolla (1979), it is not possible to precisely know the percentage of the world's population which can be classified as peasants. In fact, many rural dwellers in low, and particularly middle-income countries, either do not farm or farm on a strictly commercial basis. However, any decrease is relative to expanding urban populations and does not necessarily imply an absolute decline in peasant numbers, since rural population growth rates remain high overall in many parts of the world and wage workers, not peasants. Nonetheless, his influence on subsequent peasant and smallholder literature is his basic assumption that the agrarian sector by its very nature was incapable of achieving high levels of labour specialisation or productivity.

The natural division of labour leads to transpire a proportional increase and also positively influences the productive power of labour. Manufacturing is different compared to agriculture because it does not admit so many subdivisions of labour. For instance, in agriculture, the spinner is almost always a different person from the weaver, whereas the ploughman, the harrower, the sower of the seed and the reaper of the corn, are often the same people doing these jobs in different seasons over the year. Ricardo's 1946 (1817) argument for the repeal of the Corn Laws was premised on the significance of focusing on national labour productivity.

In his argument, there is an emphasis on the possibility of increasing productivity in farming industries by application of scientific advances, utilising those advances to maintain soil fertilisation and mechanisation, in order to make it possible to reduce labour inputs. According to Lenin (1974 a), the classical political economists classified peasantries based on their income and assets holdings, but ultimately they are technologically backward producers. For Bowmaker-Falconer (2018) the 4IR will impose a threat and distress about job losses, particularly in the domains of semi and unskilled labour. The agricultural technologies will create new types of jobs that specifically need certain skills through training and education.

According to Bowmaker-Falconer (2018) technology is a critical part of the 4IR, and features like energy, the environment, economics and policy, including consumers, will experience social change when all the 4IR integral drivers take full control. Bowmaker-Falconer (2018) asserts that the scope of the 4IR is more than just smart and connected machines in the workplace. Artificial intelligence and autonomy have been modified and advanced in such a way that integral parts of the new industrial era produce powerful connection technologies re-shaping our societies. That also differentiates the 4IR from its predecessors, by its speed and powerful technologies. The 4IR will be touching every aspect of human life and technological changes through the internet and will be available and accessible at a relatively low cost.

Small-scale farmers are good at implementing short-term strategies, but that does not favour long-term investments, so they end up being weak on the long term investment capacity, and this affects their working performance and output (Dassisti, Giovannini, Merla, Chimienti, Panetto (2018) Issa, Lucke, Bauernhansl (2017). According to IFAD (2012), small-scale farmers have managed to grow and sell their products using what they have at hand. Jee (2017, 255-256) asserts that consumers are likely to gain the most from the fourth industrial revolution and be more involved in the products they use. As a result, the producers will know what is needed and transportation and communication costs will drop. As a further result, the global supply chains will be more effective, and the cost of trade will decrease because there will be innovative markets to drive economic growth. Using 4IR technologies in farming has led to agricultural technologies and greater resistance of quality crops to improved working

conditions. Additionally, the development of agriculture harnessing the 4IR assists not only farms but works well for sustainable development (Adnan, Nordin, Rahman and Noor, 2017). Moreover, the cross-analysis of environmental issues assists the prediction of climatic and cultural factors to establish the nutritive needs of the crops, and also identify weeds before they multiply. In that manner, farmers will possibly be able to save agricultural material.

According to Chen, Dowman, Li, Madden, Mills, Trinder, (2016) and Halachmi, Adan, Van Der Wal, Van Beek, & Heesterbeek, (2003), technological development will advance autonomous driving technology, such as driverless tractors monitoring the farming fields. Although commercial farmers use automated machines, some fruits, such as strawberries, and vegetables in most geographical areas, including advanced countries, fundamentally depend on manual labour (Al-Razgan, Alfallaj, Alsarhani, & Alomair (2016) There is also an interest in smaller tractors which are affordable for small-scale farmers, and they can also practise the use of robots (Zhang, Wang, & Sun, 2012).

As Liebenberg *et al*, (2010) state, since 1947/48 the intermediate inputs have increased; their share of total costs in 1947/48 was around 30% and continued to increase to 50% in 2006/2007. Moreover, the capital costs increased within the same period, whilst labour costs dropped from 36% in 1947/48 to 15.1% in 2006/07. Agriculture experienced this change because of the introduction of tractors in the mid '70s. The twenty-first century has influenced the extreme decline of the area planted, due to increasing costs of operation leading to a reduction in the number of farmers and then of land planted. Also, the small-scale farmers can use small air drones that have specialised roles and other agricultural vehicles and collaborate with each other and keep in constant communication (Demir, and Cicibas, 2017). Greater interaction with the environment, and the success of the 4IR, depend on the acceptance by individual farmers of several additional factors, such as suitable practices that the farmers can relate to and afford. In that manner, the small-scale farmers can be part of the 4IR movement and benefit on their own level, although being strapped to compete with commercial farmers.

**3.3.26. Table 3: To feed almost 10 billion people by 2050, while meeting the Sustainable Development Goals (SDGs), food systems will need to be:**

<b>Inclusive</b>	The economic and social inclusion of all food systems actors will enable small-scale farmers, women and youth to access financing, education, insurance, transport, and mechanisation leasing. Furthermore, businesses, governments, international organisations and other food systems stakeholders will provide farmers with the accurate infrastructure, policies, regulations and services they need to succeed.
<b>Sustainable</b>	decreasing negative environmental impacts, preserving scarce natural resources, convertible biodiversity loss and strengthening resiliency against future shocks. Companies and farmers to share more information about agricultural sustainable practices. Farmers use practices that reduce environmental damage and are conscious of their land's value, while countries specifically monitor their food systems environmental effects, land rights and plan for land use.
<b>Efficient</b>	Producing adequate quantities of nutritious foods and supplying healthy foods for global needs while minimising loss and waste. Food is produced in the right variety and in the required amounts to nutritiously feed the world with quality output to meet the customer's needs. Also, less food will go to waste; moreover, any food that is not consumed will be delivered to those in need, for reuse to create other goods or recycled into other uses, such as compost. The government policies will positively monitor the decision-making of all actors towards common objectives in agriculture. Including land and other resources to be utilised in their full potential and shared equally. Above all, price volatility will no longer be an issue for small-scale farmers.

Source: United Nations Department of Economic and Social Affairs (2015)

Even though there are sustainable development goals to resolve all the agricultural challenges the major issues should not be left unattended to change the livelihood of people globally. The educational platforms on how to save food are a great tool to alert

and educate people on how to meet farmers halfway on saving food while there are other existing agricultural challenges faced by small-scale farmers.

## **CHAPTER SUMMARY**

Even though 4IR technologies have brought magnificent transformation for many sectors, expanding their production and profit, the threat of the 4IR cannot be ignored, more especially the impact it will have on small business development in the absence of proposed policies mainly for small and middle business. This fast train somehow requires skills and impressive intelligence from employees. For instance, there is a greater possibility of the 4IR technologies exacerbating inequality and disrupting labour markets, which puts more pressure on small-scale farmers to purchase the new agricultural machines, meaning less profit. Agriculture is typically a rural activity, and as a result, it is perceived as particularly relevant for eliminating poverty and enhancing livelihoods and access to social services. The classical/political theory (Smith, 1779) and capability theory Sen (1980) emphasised the importance of evolving people as individuals, rather than just working towards the development of a country, while millions of people continue depending on government funds.

Agriculture has saved many lives, but even if the technology advances one may not turn a blind eye to the fact that people in rural areas will always require patience and determination in order to fully change their living space. Also, small-scale farmers have worked with what is available to them, which should enlighten sponsors and stakeholders about the need to invest more in them to produce extra, without them feeling inferior and outcast by government policies and decisions made on their behalf, which are not aimed at improving the challenges they face but to enrich the ones who can afford to adjust easily financially and physically. In 2014 Industry 4.0 was strongly cited, while Agriculture 4.0 has only recently been quoted. Government interventions to assist small-scale farmers have not served their purpose because the adoption of the 4IR technologies is basically more interested in the big producers in the agricultural sectors (Kolberg, Knobloch, and Zuhlke, 2017)

## **CHAPTER 4**

### **RESEARCH METHODOLOGY**

#### **4.1. Introduction**

The previous chapter contained an extensive literature review on technology (4IR) in agriculture and small-scale farmers globally. The use of the qualitative research paradigm in this study will be expounded on in this chapter and the reason behind using qualitative data analysis. The procedures or strategies used to find, select, process, and analyse information about a topic is referred to as research methodology. Consequently, the methodology portion of a research article allows the reader to critically examine the study's overall validity and dependability. According to Mertens (2015), research can be seen in a variety of ways in order to comprehend the process of systematic inquiry, which includes activities such as collecting, analysing, and interpreting research data. This chapter discusses the research methodology of the study, using the strategies research method, research approach, methods of data collection, selection of the sample, research process, type of data analysis, and also ethical considerations including research limitations of the study (Sileyew 2019).

The researcher implements a particular research design suitable for the study in order to structure the research and to demonstrate all the major parts of the research project, namely, the sample, measures, and methods of study. As Babbie (2007) asserts, the research design is a plan particularly used during the conducting of a research study. Ganzalez, Forister (2020); Creswell and Poth (2018) assert that there are a variety of techniques used in qualitative research, as well as a variety of data gathering and analytic methodologies. According to Leedy and Ormrod (2010:2), research is a consistent process where a researcher collects, analyses, and interprets information to add more insight based on the particular phenomenon of interest relating to any study or case. Welman, Kruger and Mitchell (2005:2) assert that research is a process of obtaining scientific knowledge by consulting and including various objective methods and procedures. Irny and Rose (2005); Yin (2017) note that research methodology offers the theoretical underpinning of different methods for the best practices which may be adopted.

## **4.2.THE RESEARCH DESIGN**

The important thing about the research design is that it is a comprehensive plan on how the data collection will be accomplished and outlines it empirically as a research project. Also, it works as a specific “blueprint” for the empirical research aimed at answering specific research questions and for testing specific hypotheses, and must specify at least the following three processes: (a) the data collection process, (b) the instrument development process, and (c) the sampling process (Kelemen and Rumens (2008); Thomas, Nelson & Silverman, 2011). This is done during the process of considering theories, ideas, concepts, hypotheses, and research findings regarding the roles they play as instruments of thought and action. As Bhattacharyya (2006); Thomas et al., (2011) maintain that research design is done attentively for systematically solving problems and gaining new knowledge.

## **4.3.THE RATIONALE FOR QUALITATIVE RESEARCH DESIGN**

Researchers are allowed to use qualitative or quantitative research depending on the configuration of the study. This study adopted a qualitative research methodology. According to Silverman (1993: 170); Housley, Dicks, Henwood (2017); Kennedy, (2018 ) qualitative methods are more focused on how ordinary people observe and describe their lives. For Payne and Payne (2004); Renold and Ivinson, (2019 ) qualitative research is a process of interpreting the meaning that people bring to their actions. As suggested by Yin (2011: 8); Chandra; Shang, (2017) qualitative research involves studying people’s lives under real-world conditions in order to understand the way they live and respond to certain circumstances. Researchers use qualitative research to collect rich, descriptive data in respect of a particular context with the intention of developing and being considerate of what is being observed or studied. Moreover, the research methodology adopting the qualitative research approach is concerned with understanding the social and cultural contexts which underlie different behavioural patterns and is mostly associated with exploring the “why” questions of research” (Maree, 2007: 51; Renold and Ivinson, 2019). Qualitative research studies people by interacting with and observing the participants in their natural environment and their interpretations. Qualitative research puts more emphasis on the quality and depth of information than on the scope or breadth of the information provided by participants.

Qualitative research interprets reality from the participants, events and ideas which emerge from the research; representing the meaning given to real-life events by the people who have experienced a particular type of event (Bless, Higson-Smith & Sithole, 2013; Halloway and Wheeler, 1996). In this study, the participants provide insightful responses on “The place of the Fourth Industrial Revolution in Small-scale farming at KwaDlangezwa, KwaZulu-Natal, South Africa”.

Deciding on the qualitative research design for this study was imperative in order to cover contextual conditions namely, the social, institutional, and environmental conditions within which people’s lives take place (small-scale farmers). Moreover, these contextual conditions in many ways are strongly influencing farmers’ events (commercial or small-scale farmers). According to the available literature, it is assumed that many of the factors which affect small-scale farmers are related to the sewed agricultural policies /law that were previously implemented. As noted by Creswell (2014:15) the researcher consistently analyses words, reports views of informants and restricts the study to its natural setting. As a result, the participants are well knowledgeable of the 4IR and farming techniques, which made it easy for them to answer the research questions. Moreover, the qualitative approach was considered most suitable and relevant to the study for “how” questions (for instance, in this study a question on “How will the 4IR characteristics develop small-scale farming” was used). The primary research question of this study was to ask how, from a small-scale farmer’s point of view, the Fourth Industrial Revolution (4IR) will benefit and stabilise/sustain agricultural sectors (small-scale farmers) in KwaZulu-Natal (KZN), South Africa.

In order to answer this, and other research questions, the researcher sought the views from small-scale farmers and other relevant participants, those who are involved in different types of farming. Also, the study invited non-farmers (but organisations working with farmers) in order to accumulate more information from their perspectives.

#### **4.4. RESEARCH METHODOLOGY**

Leedy and Ormrod (2010:6); Blackstone, (2018). state that is it important for the research project to use the framework that is fit to underline and produce a reliable and relevant study. This helps to smoothen the process and dictates how the data is acquired and also arranged in logical sequences, setting up an approach and finally

yielding conclusions. Furthermore, Welman, Kruger and Mitchell (2005:2); Neuman (2014) note that research methodology also explains the logic of the research methods and techniques to be used, but the scope is wider than research methods. According to Leedy and Ormrod (2010:6); Silverman (2015), research methodology has two main functions:

1. To direct and control the acquisition of data.
2. To organise data after its collection and extract implications for the study.

#### **4.5. DATA COLLECTION METHOD AND TOOLS**

The research instruments are the tools used to collect and analyse data. These tools enable researchers to gather data about social reality from individuals, groups, and artefacts (Hesse-Biber and Leavy 2011). As Bengtsson, (2016) states, the research method includes interviews, observation, and/or the collection of textual and visual data. It is generally accepted that it is essential to ensure a tight fit between the purpose or research question and the method. Moreover, a methodology is like a bridge that brings our philosophical standpoints together. Methodology entails the understanding of the events (phenomena) taking place in the world.

For Kothari (2004:95); Polit, Beck, (2012) there are two types of data, namely, primary and secondary. Primary data refers to data that is composed afresh from the participants and this happens to be original to answer the study questions. Hence, this study used in-depth interviews and open-ended questions, to collect data to answer the objectives, and questions of the study at hand. Secondary data is used to put together the literature review, which was duly done in chapters two and three, supported by theories underpinning this study. The appointments and arrangements for the interviews to answer the research questions were approved by all the participants according to their roles and duties. It was imperative for the researcher to interview farmers while they were working on their fields as this assisted in understanding what and how exactly are they do they work. Moreover, the researcher was able to capture pictures of their working equipment and machines (farming tools)

for discourse analyse. The engagement of the participants in this study assisted the researcher to add extensive information and contributing something new to the existing body of knowledge. The research questions for interviews were in English or isiZulu and the duration was approximately 30 minutes per participant.

## **4.6. DATA COLLECTION**

Given the above multitude of research designs, researchers choose the one most suitable for their research. Generally speaking, researchers usually select those research designs that they are most comfortable with and feel most competent to handle, but it is vital that the choice should depend on the nature of the research phenomenon being studied (Paley, 2016). Regardless of the specific research design chosen by researchers, the study should strive to use quantitative and qualitative data using a combination of techniques namely, questionnaires, interviews, observations, documents, or secondary data.

For instance, even in a highly structured survey questionnaire that is intended to collect quantitative data the researcher may leave some room for a few open-ended questions to collect qualitative data with the purpose of generating unexpected insights not otherwise available from structured quantitative data alone. Lastly, Creswell (2002:85) offers the opinion that while case research mostly uses face-to-face interviews to collect mostly qualitative data, the potential and value of collecting quantitative data should not be ignored. Sampling and data saturation in qualitative research is an important aspect that must be considered at the design stage of a research study, in order for the project to be productive.

### **4.6.1. What is sampling ?**

Sampling plays a significant role in research. It is a tool used to select a particular number of participants using a statistical process of selecting a subset called a “sample” Daniel (2012); Mc Comber, (2021). The selection of a sample is based on the researcher’s interest and for the purpose of making observations and also

statistical inferences about a specific population (in this case, small-scale farmers). As a result, it is not possible to study the entire population, because of feasibility and cost constraints. That is where the sample comes in handy at reducing the number of the

population to be interviewed; hence the selection of a representative sample from the population of interest for observation and analysis is of great importance (Kateman and Buydens, 1993). Thus, it is extremely important for the researcher to choose a sample that is truly representative of the main population so that the inferences representative of the sample can be generalised back to the population of interest (Brynard, Hanekom and Brynard, 2014). Sampling has two types of sampling methods, namely, the probability and non-probability methods. Under probability methods, there are simple random sampling, stratified random sampling, systematic random sampling, and cluster random sampling.

Forman, Creswell, Damschroder, Kowalski and Krein, (2008) assert that sampling in qualitative studies is essential in order to reduce the number of participants. Qualitative methods are well suited to obtaining quality data and producing new findings (Patton, 1990), unlike quantitative methods, which typically depend on larger samples selected randomly. In other words, the purpose of purposive sampling is to select information-rich cases whose study will illuminate the question under study, in this case, 'The Fourth Industrial revolution and small-scale farmers at KwaDlangezwa, KwaZulu Natal in South Africa'. Yin (2011) asserts that the main goal of purposive sampling is to have those (participants) units that will yield the most appropriate and plentiful data. Additionally, Kuzel (1992: 37) follows the same reasoning when he states that "a sample should strive to obtain the broadest range of information and viewpoints on the subject of a study".

#### **4.6.2. Non-probability sampling**

Kothari (2004:59); Yin (2003) clarify that non-probability sampling is a sampling procedure that does not give any basis for approximating the probability that each person in the population has of being included in the sampling. Therefore, without such a characteristic, the researcher will struggle to evaluate the sample in the context of normal distribution (Rea and Parker, 2005:172). The researcher was well aware that not all the farmers would be granted an opportunity to participate, so the study focused on the following to fill that gap.

- **Quota sampling**

The researcher first identified relevant groups of cases or people, then decided from the total number of people available on how many to get in each category (Davis, 2005).

- **Snowball sampling**

The researcher at this stage initially got a number of sampling units who were randomly selected, and later, additional sampling (participants) units were selected based on a referral process (Breweton and Millward, 2001). The researcher was able to reach more participants, without a waste of time and money during data collection (small-scale farmers know each other, within the same area)

#### **4.6.1.1. Haphazard Sampling**

The haphazard are easiest to obtain because participants are selected and interviewed without making any appointments, for instance for a new product on the markets. Non-probability sampling was used in this study. The study used purposive sampling, as farmers in KwaDlangezwa are familiar with each other which made it easier to arrange appointments with individuals relating to the study topic (Maruster, 2013).

Primary data was used to answer the research questions. The study used unstructured interviews to address the open-ended questions. In this study, appointments were arranged for interviews in the department of agriculture, and with lecturers from the University of Zululand, a traditional leader (Inkosi or Induna), community members in KwaDlangezwa (customers), students and lecturers at Owen Sithole College of Agriculture, a specialist at University of Johannesburg and Agriculture Research Council and, lastly, small-scale and commercial farmers in KwaDlangezwa. The study used secondary data such as relevant books,

articles/journals, unpublished theses, magazine publications, research projects, newspapers, relevant documents, papers, documentary records, reports and the Internet. Secondary data is essential during research because it lays a concrete foundation and eliminates the chances of the researcher repeating the published work. In this case, the secondary data helped validate statements of the participants during interviews. Participants' involvement was voluntary; thus, they could withdraw at any time.

#### **4.6.1. Sampling Methods**

According to Ritchie & Lewis (2003); McCombers, (2021); Palinkas, Horwitz, Green, Wisdom, Duan , Hoagwood (2015) qualitative research also focuses on purposive sampling. This study used a purposive sampling selection because the researcher had the purpose in mind of interviewing selected small-scale farmers. By the looks of things, from the beginning sample selection was not difficult - simply because the study area is surrounded by small-scale farmers and commercial farmers. The most important point is that purposive sampling contains homogeneous samples which, according to Holloway & Wheeler, (2002) and Patton, (2002) are individuals who belong to the same subculture also have the same characteristics and are easily chosen to give a detailed picture of a particular phenomenon. The members of a sample have been chosen with a "purpose" to represent a phenomenon (Curtis, Gesler, Smith and Wash-burn 2002). There are six criteria identifying 'sample':

1. First and foremost, the sampling strategy should be relevant to the conceptual framework and also to the research questions addressed by the research (for example, selection of small-scale /commercial farmers).
- 2.The sample should generate rich information on the type of phenomena that need to be studied, to validate that they were correctly selected from the start.
- 3.The sample also should produce credible descriptions/explanations (in the sense of being true to real life) for the readers and other farmers to be relatable and gain new knowledge.

4. The main aim of the sample is to enhance the transferability of the findings.

5. The sample should take ethical preconditions (such as vulnerability, informed consent). (The University of Zululand granted the researcher ethical clearance).

6. Above all the sampling should be feasible in terms of money and time, and practical issues of accessibility have to be considered. With regard to this study, the sample was local and the data collection took approximately 3 months including personal and telephone interviews (Curtis, Gesler, Smith and Washburn 2002).

#### **4.6.2. The importance of describing a sample and participants**

The researcher in this stage is as detailed as possible while stating the number of participants, mentioning how they were selected and giving relevant background data such as age, sex, occupation, education and marital status of the participants. The above information is needed when collecting data because it is important to get factual details on items such as level of education. If the farmers are educated, they are more likely to be familiar with the use of agricultural technological tools. Also, age will have an influence; for instance, older farmers are used to the old ways of farming compared to younger farmers who hold rejuvenated thoughts and are capable of insightful decision-making.

#### **4.6.3. Participants**

According to Palys (2008): Maxwell, (1996). purposive sampling is a non-probability sample that is assured based on the characteristics of a population and focuses on the objective of the study. This helped to discover factors contributing to existing challenges faced by farmers. Interviewing the farmers was more informative since they dealt with these challenges on a daily basis, they are experts at the farming business, and they have different agricultural experiences.

#### **4.6.4. Population**

Welman, Kruger and Mitchell (2005:52) and Neuman (2011:224) state that a population is the total collection of all units of examination that the researcher desires to study. The method of purposive sampling was used to develop the sample of the

research under discussion and research objective. Based on this method, which appropriately falls under the category of non-probability sampling techniques, members of the sample are selected on the basis of their knowledge, relationships and expertise regarding a research project's subject matter (Freedman, Pisani and Puves, 2007). In this study, the sample members who were selected had a special relationship with the topic under investigation, namely, adequate and relevant work experience in the field of agriculture.

#### **4.6.5. Definition of qualitative research**

For Polkinghorne (1989); Vanderstoep and Johnson (2009) the distinctive feature of qualitative research are Linguistic data (words) rather than numerical data, and it also uses meaning-based rather than statistical forms of data-analysis. Furthermore, its main focus is to view social life in terms of processes that occur rather than in static terms. Berg (2007:7) asserts that qualitative research seeks answers to questions by inspecting various social settings and the individuals who inhabit these settings. Elliott and Timulak (2007) raise some other important features linked to qualitative research, such as exploratory research questions, and understanding different phenomena.

#### **4.6.6. Qualitative Research**

According to Lincoln and Cuba, (1985) and Denzin and Lincoln (2005) qualitative research focus on the following dimensions to increase its trustworthiness (reliability): credibility, transferability, dependability and confirmability. Agar (2001:107), states that in qualitative data collection it important to focus on the intensive personal involvement and in-depth responses of individuals in order to secure a sufficient level of validity and reliability. It is imperative that qualitative research includes the degree to which the interpretations and concepts used have mutual meaning. Merriam (1998) classifies five strategies to ensure internal validity in qualitative research. These are:

**Crystallisation:** This involves literature, sources and methods used to compare the findings.

**Member checks:** This is an importance stage, where the data and findings are verified by participants other than those originally involved.

**Long-term observation:** The researcher gets a chance to gather data over an extended period in order to increase validity, such as the pilot study which was adopted in this study.

**Collaborative research:** In this stage, the researcher gets to know the involved participants in the research process.

**Clearing researcher bias:** Before the researcher commences the study it is vital that their assumptions, views and theoretical orientation are clarified.

The qualitative research approaches are deliberately designed to scientifically explain the different events experienced by people on a daily basis. According to Fox and Bayat (2007:7) and Green (2005:46), qualitative research can be the main paradigm of research in the social sciences. Gravette & Forzano (2006), also agreed on that, noting that the qualitative approach involves the collection of phenomena and transforming them to data for a better insight into phenomena of interest in humans. As a result, the study is classified as qualitative research if the purpose of the study is primarily to delineate a situation and/or phenomena.

Qualitative research specialises in making sure that the appropriate small samples are easily gathered, but its results are not measurable and quantifiable. This is its basic benefit, which also establishes its basic difference from quantitative research. Collis & Hussey, (2003) assert that qualitative research offers a comprehensive description and analysis of a research subject, with no limitations to the scope of the research and the nature of participants' responses during interviews. Moreover, the efficiency of qualitative research is crucially based on the skills and capabilities of the researchers themselves, because the results mostly come from the researchers' personal judgments and interpretations after data analysis. It is important that the researcher uses appropriately small samples, even though it is risky for the results of the research to be perceived as also reflecting the opinions of a wider population. It also better serves for concluding something viable and reliable – it is just that not everyone gets a chance to participate (Bell, 2005).

This study focuses on qualitative research methodology to collect and gather more insight and appropriate information from the views of the participants. According to Frankfort-Nachmias and Nachmias (1996:245) and Neuman (2011:272), the survey method is also part of the data collection process. In fact, it serves as the most important tool in the process of data collection in the social sciences. The survey helps to answer the question of who, how, and what related to the fields as it is used extensively to collect information on several themes of study and allows the participants to answer based on what they are asked, particularly on the questions of the study. Survey is undoubtedly the best method available to a social researcher who is interested in collecting unique data in order to define and measure attitudes and orientations in a large population which, in this case, is small-scale and commercial farmers in South Africa. Lastly, the survey may be used for descriptive, explanatory and exploratory purposes, especially where individuals are the units of study (Miles & Huberman (1994, 40).

## **4.7. RESEARCH INSTRUMENTS**

### **4.7.1. Types of interview**

Interviews are divided into a structured interview, semi-structured interview, and in-depth or unstructured interview which often takes the form of a conversation. This is done with the intention to explore and interact with the participants while sharing their views, beliefs and attitudes about certain events or phenomena. According to Lofland and Lofland, (1995) and Weber, Mason Carter and Hew (2011) participants may propose solutions or provide recommendations or insights into events before the researcher analyses the interview answers.

### **4.7.2. Semi-structured interviews**

Semi-structured interviews are frequently used in qualitative analysis. In a semi-structured interview, the researcher monitors the standard questions with one or more additional questions. A semi-structured interview also allows the researcher to probe and ask the respondents for further views/opinions where it is necessary for respondents to further elaborate on their answers and give more insight into 'why' and 'how' questions. During the interview, the order of questions may change depending

on the direction the interviewee and interviewer take, which is an excellent idea because the study gets more information and broadens its conceptualisation (Leedy and Ormrod, 2010:188; Gray, 2009:373; Neuman, 2011:407).

#### **4.7.3. What is an interview?**

The interviewer asks questions during the two-way conversation and the participants share their ideas, beliefs, views, opinions and behaviours to give more insight into the study. The aim of qualitative research is to have open-ended questions, designed to see things through the eyes of the participants, and they can be a valuable source of information. The main aim of interviews is to obtain rich description data that will help the reader to understand the participant's construction of knowledge and social reality based on the study at hand. The benefit of personal or telephonic interviews is that if the person you are interviewing is knowledgeable about the topic, they will give you information that you will not be able to collect in any other way. According to Gray (2009:369), an interview is a conversation that takes place between participants and a researcher; the researcher always leads with the questions to direct and control the data collection while maintaining the flow of the interview. Leedy and Ormrod (2010:148) are of the opinion that interviews produce very useful information. Moreover, interviews give the researcher a platform to ask questions relating to any of the following with regard to this present study:

- Facts (about the situation at the farming fields)
- People's beliefs and perspectives about the facts (about their rationale, based on the subject matter of the study; 4IR and farming)
- Feelings (How are they feeling about the study questions)
- Motives (What is their reasoning on the subject matter)
- Present and past behaviours (what do they understand about the 4IR and its implications, and other revolutions)

- Standards of behaviour (The participants behaviour will tell and show how they feel, and it is the duty of the researcher to stay calm and be professional)
- Conscious reasons for actions or feelings (The participants will understand that certain behaviours are desirable or undesirable, with regard to the origins of the revolutions and change imposed to agriculture). Leedy and Ormrod (2010:148)

Gray (2009:369) observes that in some situations during interviews the researcher is able to examine the feelings or attitudes of respondents. This has both a positive and a negative side. In the case where the researcher and participants find themselves in an awkward and uncomfortable zone, this can jeopardize the research by providing less information. Also, when they are too relaxed they can end up deviating from the objectives of the study and as a result, the information collected may not be accurate or relevant. It is advisable that the researcher controls for such instances before they take place and is the director and monitor of the entire interview session. It is important to be professional and keep in mind that the aim of the study is to answer the research questions. The researcher used a recorder and camera, and also have two assistants taking down notes for the additional questions, but this is compulsory.

#### **4.7.4. The role of the interviewer**

Wilson, (2016); Creswell, (2008); and Silverman, (2015) found that the interviewer has a complex and multi-faceted role in the interview process, which includes the following:

- 4.7.4.1. ***Prepare for the interview:*** The interviewer is in control of data collection. As a result, the quality of data collected depends on the expertise of the interviewer in carrying out the job. This also requires the interviewer to be well trained in the interview process and the survey method and to be familiar with the purpose of the study. With so much knowledge, the interviewer will know how the responses will be stored and used, thereby eliminating the chances of being biased.
- 4.7.4.2. ***Locate and enlist the cooperation of respondents:*** It is the duty of the interviewer to locate specific addresses, and work around participants' schedules.

At some point, this might mean that the interviews take place at undesirable times, such as during weekends/holidays.

- 4.7.4.3. **Motivate respondents:** The interviewer leads and breaks the ice, allowing the participants to follow or imitate her or his energy. Whenever the interviewer shows signs of being disinterested or inattentive the participants will give back the same energy. The interviewer should demonstrate enthusiasm about the study, also communicate the importance of the research to participants, and be attentive to participants' needs throughout the interview sessions.
- 4.7.4.4. **Clarify any confusion or concerns:** Interviewers must be able to contribute freely from their experiences and be able to address unanticipated concerns or objections raised by participants for their own satisfaction. (Since this present study adopted open-ended questions, the participants were allowed to ask probing questions as necessary even if such questions were not in the script).
- 4.7.4.5. **Observe the quality of participants:** The interviewer is in the best position to judge the quality of information collected. This may take place during the interview. Also, the participants can show uncertainty with their answers, which can be seen by observation of gestures and/or body language.

#### **4.7.5. Conducting the interview**

Interviews are a process of primary data collection compared to questionnaires and are led by trained interviewers using the same research protocol as questionnaire surveys. The interview script contains special instructions for the interviewer that are not seen by participants. In addition, the interviewer has the opportunity to clarify issues raised by the participant while probing or follow-up questions are taken into consideration. However, interviews on the other hand is time-consuming and resource-intensive, and additional require special interviewing skills in order to obtain sufficient data.

The study used a face-to-face interviews, and telephone interviews where the interviewer worked directly with the participants, asking questions and recording their responses. This took place at the location preferences of participants. This approach

has been used by most researchers, acknowledging that participants feel comfortable in their own living spaces.

It is common practice in qualitative research to use face-to-face interviews when conducting semi-structured and in-depth interviews (Lariviere and Kandampully, 2019; Witell, Holmlund, and Gustafsson 2020), but Fenig and Levav (1993); Stephens, (2007); and Opdenakker, (2006 ) note that telephone interviews are handy in many instances, as mentioned above., especially given the Covid 19 restrictions applied by most business sectors. Coronavirus disease 2019 (COVID-19) presented an opportunity to evaluate and gain important new insights into online meetings such as Zoom and Teams. According to Azzari and Baker, (2020); Witell, et al., (2020 ), telephone interviews increase participants' perceptions of anonymity. Lastly, telephone interviewing is advantageous when it comes to cost-saving. However, even though telephone interviewing is popular, and was used by this researcher, there are challenges along the way such as network failure. In this particular study, a call got cut off because of network failure. As a result, this interrupted the flow of the conversation and the recording process.

#### **4.7.6. Recording interview data**

On this point, the researcher recorded the participants' responses both in writing and digitally, after the interviewer and interviewee agreed to work together with no hidden agenda. The agreement between both parties made things easier after permission was granted to the researcher. As the recordings needed back-up, such as taking notes to elaborate on points being made, the researcher used the recorder and camera to capture more information. After the interviews had been successfully done, the interviewer listened to each and every recording for the identification of any possibly missed information or new information to be explored in a follow-up interview.

### **4.8. DATA ANALYSIS AND INTERPRETATION**

#### **4.9. The preparation of data**

After collecting data from participants, the researcher prepared the data by screening and transcribing it and getting it ready for analysis, which is an important step in the qualitative data -analysis process (Miles and Gilbert 2007). As for, Bengtsson (2016)

asserts that the researcher should be vigilant when it comes to checking and auditing all steps of the analysis, as they are a natural part of qualitative research. Moreover, any analysis of qualitative data should be done in a systematic and organised manner, so that the researcher can easily locate information in the data set, and analyse the data as soon as possible (Lovric, Prlic, Milutinovic, Marjanac, & Zvanut, 2017).

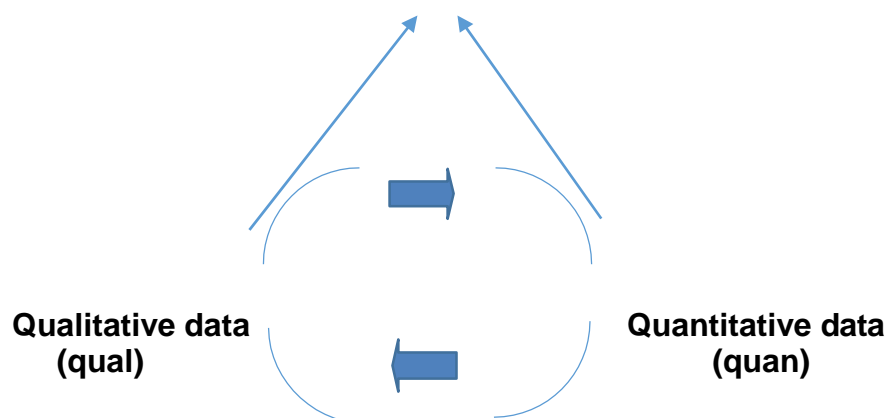
Babbie and Mouton (2009) note that the significance of data analysis and interpretation is to help the researcher to easily arrange the findings of the study after data have been collected. The study used qualitative data collection analysis which, as has been described previously, is a process of putting together different ideas from various participants' views and opinions based on the given study and situation at hand. Scott and Usher (2011) postulate that the qualitative analytical approach comprises the coding or classifying of field notes, by observations or interview transcripts either inferring from the words being inspected, or from the repeated use of words (phrases) what pattern or themes are developing and initiated as a result. Khanzode, (1995); Saunders, Sim, Kingstone, Baker, Waterfield, Bartlam, Burroughs, and Jinks (2018) that participants' answers can later be arranged according to patterns, themes, and categories with regular similarities. During the process of qualitative analysis, this study utilised in-depth interview and audio recording interpretation through open coding, identifying concepts and key ideas of the findings. Open coding is vital since it digs deeper into the hidden points of view as participants respond. Data interpretation demands more time and deliberation since it looks for similarities in concepts which are later grouped as open coding. According to Edhlund (2008); Woolf and Silver, (2017) the Atlas. ti is a tool to analyse data, a software program that supports qualitative and mixed methods research by helping researchers during the process of organising and analysing the findings.

#### **4.10. Discourse analysis**

According to Jorgensen and Phillips (2002); Wu Hongyan (2008); Wei Xinxin, (2010) for the past two decades "discourse" has been a used term in scientific texts and there is a lot of debate that the term has not been fully been defined. As a result, the concept has become vague, either meaning almost nothing or being used more precisely. Discourse is an ever-present way of valuing and experiencing the world and the

instances taking place on daily basis. For Wittgenstein (1971) discourse analysis is more concerned with studying and analysing written texts and spoken words to reveal the conversational sources of power, inequality and bias from different occurrences. Discourse also plays a role in initiating, maintaining, reproducing and transforming within specific social, economic, political and historical contexts. As a result, participants are able to respond effectively.

The study also made use of theoretical triangulation by using classical /political economy theory and capability theory Mitchell (1986); National Science Foundation, 2019). Banik (1993) and Murdock (2019) argues that the benefit of theoretical triangulation is that it provides a broader and deeper analysis and enhances research findings. The approach of triangulation is used to boost the credibility and validity of study findings. Theoretical triangulation improves the confidence of the accepted hypothesis and theory when data findings are finally tested against an opposing hypothesis or theory. Moreover, triangulation is critical in facilitating explanatory validity (Terre Blanche & Durrheim, 2004). It also establishes data trustworthiness, which requires researchers to check the extensiveness of the conclusions based on qualitative sources supported by a quantitative perspective, and vice versa. As Maxwell (1996:93 :Korstjens,2017)



#### 4.8.2.1. Figure 2: Triangulation of data collection

Source: Joubert (2005); Kennedy (2009)

In the above diagram, Joubert (2005) maintains that the solidarity of data collected during a study will bring more meaning by being analysed from an integrative perspective. Data and information obtained should result in something innovative. In support of this, Lincoln & Guba, 1985:37 state that the “validating” of results requires multiple methodologies of data collection and analysis to be practised.

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#### **4.8.3.1. What is coding**

According to Werts (1983); Woods, Paulus, Atkins, Macklin, (2016); Miles and Huberman (2020) coding is where a researcher goes through a process of reading carefully through their transcribed data, such as understanding line by line and dividing it into meaningful analytical units. There is considerable guidance in the qualitative methods literature on what to consider when forming a team for qualitative coding and analysis, but few practical examples of how to manage such a team (Jackson and Bazeley 2013; Chandra; Shang, 2017). The coding procedure is therefore defined as marking the segments of data with symbols, descriptive words or unique identifying names to analyse data into findings. There are different ways of transcribing data, for example, the use of computers.

The personal computer has proved to be excellent at manipulating text and has significantly reduced the need to transcribe data manually. Most researchers have for that reason replaced physical files and filing cabinets with computer-based directories and files. The use of word processors to write and notate text has decreased. Various dedicated, computer-assisted qualitative data-analysis programmes have been developed to make it easier to code and retrieve text. Additionally, there are now other functions like searching and enumerating. Currently, the most popular qualitative data-analysis packages are Ethnography, Nvivo, NUD\*IST, and ATLAS Ti. Beginner researchers often have unrealistic prospects about these programs’ capabilities, but it

is important to bear in mind that they are not meant to replace the researcher's core role, which is to grasp the full understanding and precise meaning of the text.

#### **4.11. THE RESEARCH PROCESS**

Based on the proposal, the study was going to be carried out via face-to-face interviews, but because of the Covid 19 pandemic, arrangements had to change here and there. Even though not all participant's physical met with the researcher some agreed to do a telephone interview, which played a significant role and saved time. The meetings and appointments were arranged based on the availability of participants. Also, the researcher needed a gatekeeper from the University of Zululand and the Department of Agriculture, before data collection could commence. The researcher had to be in touch with all the participants and verify that they understood the aim and nature of the study. The interviews were conducted from July to September 2021. Since the study used discourse analysis, it was imperative to conduct the interviews and explore the farmers working tools/fields in order to discover their readiness based on what they had at hand as farmers in KwaDlangezwa. As for the department of Agriculture, lecturers, Felixton Mill and the Agriculture Research Council appointments were made through telephone communication. Owen Sithole Agriculture College and Felixton appointments for face to face interviews were made through emails. The estimated duration was to be 30 minutes. During the interviews the research assistances were going to keep the notes, to make things easier for the researcher to analyse the data.

#### **4.12. VALIDITY**

In a qualitative study, the researcher focuses on the confirmability, transferability and credibility of the study findings.

##### **4.12.1. Trustworthiness /conformability**

By verifying the quality of the study the researcher ensured that the data collected was accurate and feasible, which contributes to the quality of the research. Also, the researcher's duty was to make sure there are no errors in the study report as a result, this could have eliminated the chances of the study being biased (Tobin & Begley, 2004). Confirming this, the researcher provided the validation of the steps used to

analyse data, as a necessity to provide an audit trail, demonstrating the findings from the research and providing evidence that the outcome is solely dependent on the responses of participants interviewed and the questions answered during interviews also there is a zipped file of videos/interview recording, which are kept safe unless they are needed to fulfil assurance purposes.

#### **4.12.2. Credibility / Transferability**

Credibility deals with the questions: how congruent are the findings with reality? How do I ensure that the reader will believe my findings? Credibility is also enhanced through the development of an early familiarity with the participants and the participating organisations, but also through well-defined, purposive sampling, detailed data-collection methods and triangulation (Lincoln & Guba 1995; Creswell & Poth, 2013)

Transferability concerns the generalisability of the inquiry in qualitative research. As a result, this concerns only case-to-case transfer (Tobin & Begley 2004). Moreover, the findings are essential for the researcher because they provide valid and reliable descriptions for the other scholars to transfer the findings to their own study (Lincoln & Guba, 1985).

#### **4.12.3. Pilot study**

According to Fox and Bayat (2007:102), a pilot study is an experimental run of an examination that is piloted on a small scale to regulate whether the research design and methodology will be effective for the study. This pre-test helps to determine the research instruments' adequateness and also to see if they are properly designed to capture the required data from the respondents. After the researcher has piloted the study, it is then when she or he decides whether there should or should not be any modifications and changes to the questions of the study (Hennink, Hutter and Bailey ,2011). Piloting the study helped the study to test and oversee the extremely important part of the research process. Moreover, piloting the study assisted in detecting potential problems, such as making sure that the study attains its aim and purpose, including strengthening the research design or instrumentation. In the process of collecting data, the pilot sample a small subset of the target population (in this case,

small-scale farmers) participated and some preferred telephone interview; since it was during Covid 19. After a successful pilot testing, the research may then proceed with actual data collection using the sampled population that was involved during the piloting phase.

#### **4.13. ETHICAL CONSIDERATIONS**

The concept of research is to collect data from people, based on their experience and perceptions, depending on the nature of the study. During the process of data collection, the researcher is required to keep the participant's personal details safe and confidential. Creswell (2013) cautions that participants must give the go-ahead and permission for the researcher, thus enabling the participants to participate freely. I have read the University's Policy and Procedures on Research Ethics and its Policy and Procedures on Managing and Preventing Acts of Plagiarism, and I understand their content. My supervisors and I have considered and discussed the ethical issues that arise from this research, and these are dealt with below. As a researcher I will:

- Consider and be sensitive to different cultures, languages, beliefs, perceptions, and customs of persons who will be participating either be affected by my research during data collection
- Ensure that the research is relevant both to the broad legal and development needs of the country and to the individual needs of those who may be affected by my research.
- Conduct the research and produce my thesis on my own, subject to normal supervisory and collegial assistance.
- Acknowledge the ideas, designs, and writings that are not original.
- Reference my work accurately according to my chosen reference guide, I will comply with copyright requirements and seek the necessary permissions, where required .
- Make use of text-matching software throughout the research writing process, as discussed and required by my supervisors, and will submit appropriate reports in this regard with my proposal and thesis when they are in final draft form. All the above ethical considerations were covered and attended properly.

#### **4.14. LIMITATIONS**

South Africa have nine provinces and the export and import of agricultural product reach people on a daily basis. Agriculture is divided into two variables, which are commercials and small-scale farmers. Commercial farmers may be familiar with the concept of 4IR, while on the other hand, it could be that the small-scale farmers are a

bit behind on such information, let alone on how to use it, even if they can afford to purchase 4IR products such as drones, driverless tractors and other equipment. Lastly, the researcher has selected two agricultural departments in order to have more information, simply because they are inter-cooperating and accessible to assist small-scale farmers from KwaDlangezwa. In that manner, the above limitations have been discovered at an early stage, which makes it easy to prepare in advance and have alternations also working out any obstacles hindering the success of the study.

In most instances, it is common that the study will encounter its limitations this dissertation had the following limitations:

- the study area is mainly focused on farmers at Mpangeni (KwaDlangezwa) including other farmers from other places would probably enhance the reliability of the research
- Because of the lack of knowledge based on the 4IR, it might happen that the participants give insufficiency answers and maybe be biased when it comes to answering the questions; such as being interested in the ones that they have physically experienced. Such as inadequate financial support.
- Also, the participants may refuse to speak against their employees and organisations, because they will be protecting their jobs and won't have fully trusted the researcher and the motives behind the study.

### **CHAPTER SUMMARY**

A lot has been shared in this chapter, as there are numerous approaches and traditions associated with qualitative data analysis. They all prove that there are no fixed methods or recipes that can be given on how to analyse your data. The

methodology depends on the approach chosen by the researcher. The research methodology also has to meet at least two important criteria: it must be credible and it must be trustworthy. It is quite possible that different researchers can produce findings from the same basic data set which are not identical and which have non-overlapping components. This is why the data gathering and analysis must be credible and trustworthy in order to be unique and reliable. The findings must be contextualized within the body of existing knowledge on the topic and be able to indicate how it corroborates what is already known, as well as producing new insight to uncover and enhance the readers understanding of the phenomena in question.

As a result, the data analysis should be carried out in such a way that the reader is able to relate to and have a full understanding of the conclusion about the emerging reality that is described by the findings. This chapter has explained the data gathering process of the study. It also provided the rationale for using a qualitative research design in the study, to obtain more information specifically on the small-scale farmers in KwaDlangezwa. The use of purposive sampling in the study was discussed and justified. The chapter also justified the use of telephonic interviews in qualitative research. Lastly, the study highlighted some of the ethical considerations which emerged during the study.

## **CHAPTER 5**

### **DATA ANALYSIS AND INTERPRETATION**

#### **5.1. Introduction**

This chapter is different from the previous chapters because it aims to provide in-depth analysis of the research findings obtained from the participants. Previous chapters discussed literature review and research methodology suitable for this study; this chapter provides an analysis of data based on the methodology discussed in Chapter 4. The data presented in this chapter was collected using both in-depth interview questions and telephonic interviews due to the COVID 19 pandemic rules and regulations. The findings were analysed and presented using discourse analysis, as outlined in the previous chapter. The tools used to collect data were very convenient for the researcher and participants in that they were flexible and were embraced by all the participants. Notably, the study was piloted, which contributed to the interviews proceeding successfully and in a short period of time. The researcher had six questions and sub-questions under each question directed to each participant.

Of the six questions, some were more directed to small-scale farmers while others were mainly for other participants such as the manager at the Felixton Mill and the rest of the individuals. The face-to-face interviews were conducted with community members (employed and unemployed), commercial and small-scale farmers, lecturers at Owen Sithole College, the Department of Agriculture, Traditional Leaders (Induna). The Faculty of Science and Agriculture (University of Zululand), the Agricultural Research Council.

#### **5.2.1. Table 4: State of the Province Address and programmes of action 2020**

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The SOPA 2020 (State of the Province Address) is a localised version of the State of the Nation Address, in which Premiers reflect on their accomplishments and communicate their plans for the coming year in the five priority areas of government: education, health, crime and corruption, rural development and land reform, and jobs. Premier of KwaZulu-Natal, the Hon. Sihle Zikalala delivered the State of the Province

Address at the Royal Show Grounds in Pietermaritzburg on March 4, 2020. "Together, Creating Our Common Future" was the theme for the 2020 KZN SOPA. He acknowledged that the people of KwaZulu-Natal are the cornerstone and most valuable resource. He also presented the most important elements for growth and development in the province. The table below indicates some of the highlights from the state of the province address:

PGDP GOALS		PROGRESS AND INTERVENTIONS
<b>AGRICULTURE DEVELOPMENT</b>	Radical Socio-Economic Transformation	<ul style="list-style-type: none"> <li>✓ In terms of the new KZN MTSF, 30% of funds were put aside for women, youth, and SMMEs; on specific commodities for designated groups as part of the policy.</li> <li>✓ The PGDP allocates 60% of local procurement spend to Africans, with 35% dedicated to youth, 30% to women, 5% to individuals with disabilities, and 5% to military veterans.</li> <li>✓ By 2024, there should be women-owned and led businesses to account for half of all government spending on entrepreneurship.</li> <li>✓ Land to be acquired for agricultural use under the Rural Land Reform Programme, with a target of 40% youth participation by 2024.</li> </ul>
<p><u>Summary</u></p> <p>The goal is to improve and support local individuals in KZN, which will contribute to youth and women development including people living with disabilities.</p>		
<b>AGRICULTURE DEVELOPMENT</b>	Cannabis – The green rush	<ul style="list-style-type: none"> <li>✓ The Cannabis Investor Protocol has been created and deployed.</li> <li>✓ The Moses Kotane Institute has established a dedicated and fully staffed Cannabis Unit to assist new cultivators and entrepreneurs with infrastructure, funding, and licensing.</li> </ul>

<u>Summary</u>  Support and funding has been approved to assist and develop individual emerging and small-scale farmers		
<b>AGRICULTURE DEVELOPMENT</b>	Multi-Planting Season Programme	<ul style="list-style-type: none"><li>✓ Across the province, the Department of Agriculture has helped farmers plant 10 658 hectares for food security.</li><li>✓ The provincial government has set aside R77 million to implement the planting season programme for 2020/2021.</li></ul>
<u>Summary</u>  A lot has been done in the department of agriculture and they are also continuing to do more for farmers and agricultural activities.		
<b>AGRICULTURE DEVELOPMENT</b>	Production of seeds, seedlings and fruit trees	<ul style="list-style-type: none"><li>✓ A budget of R30 million has been put out allocated for the initial phase of agricultural infrastructure, equipment, and operations, which has included the establishment of five mega-nurseries to produce seedlings and fruit trees.</li><li>✓ Implementation commenced in 2020/2021, and 290 agricultural graduates will be hired as part of the initiative.</li></ul>
<u>Summary</u>  In 2020/2021 290 agricultural graduates were hired, and eliminating youth employment was a great success.		
<b>AGRICULTURE DEVELOPMENT</b>	Youth empowerment - Sukuma 100 000	<ul style="list-style-type: none"><li>✓ The Sukuma programme contributed to youth empowerment implemented throughout all government ministries, state-owned enterprises, and our private sector partners.</li></ul>
<u>Summary</u>  Youth empowerment and development in different sectors has taken place successfully and, as a result, this will reduce poverty and unemployment.		

Source: Draft IDP Review – March 2020

The above, table shows that there are activities running and active to assist individuals, which plays a huge role in one's sustainability development. Each of the activities aims to contribute to the fruitful development and support of individuals, so it is imperative to have more stakeholders in order to have enough funds to run all the agricultural activities and programmes under the umbrella of development in KwaZulu- Natal.

### 5.3. BACKGROUND OF THE STUDY AREA

The uMhlathuze area covers 123359 ha and integrates Richards Bay, Empangeni, eSikhaleni, Ngwelezane, eNseleni, Felixton, Vulindlela, Bhucanana, and Heatonville, as well as rural territories under Traditional Councils such as Dube, Mkhwanazi, Khoza, Zungu (Madlebe), Somopho, Obizo, and a small portion of Obuka. The city of uMhlathuze (KZ 282) is located in the province of KwaZulu-Natal, on the northeast coast, about 180 re kilometres north-east of Durban. The municipality is located on a 45- kilometre stretch of coastline. The N2 motorway runs northeast through the uMhlathuze Municipality. KwaDlangezwa is under the King Cetshwayo District Municipality which has a population of 894260 inhabitants. There are two types of farming in this area, namely, crop farming, consisting of vegetables and sugarcane, and livestock farming (goats, cows and chickens). Hence, the study focused on the above types of farming, in order to get more information from small-scale farmers and how technology has enhanced and will continue to enhance their coping techniques for greater output.

#### 5.3.1. Table 5: Research Sample

Profile of participants		Participants number
<b>The first category of participants</b>		
<b>Face-to-face interviews</b>	Traditional Leaders Induna	1
	Commercial and small-scale farmers	15
	Manager at Felixton Mill	1
	Lecturers at Owen Sithole College ( Vice Principal and a student)	2
	Community members employed or unemployed	5

Second category of participants		
Telephone interviews	Department of Agriculture (Mpangeni ) Animal	1
	Department of Science and Agriculture, University of Zululand ( Added specialist in crop farming )	2
	Agricultural Research Council	1
	University of Johannesburg(specialist in 4IR) ( <b>cancelled</b> )	0
	Faculty of Physics, the University of Zululand ( <b>cancelled</b> )	0
	<b>Total</b>	<b>28</b>

Source: Authors creation (2021)

The above table shows that 28 participants engaged and expressed their views on the 4IR implications in agriculture and small-scale farmers in KwaDlangezwa. Their views and perceptions on the ongoing agricultural technology proved that they have a broad understanding of the 4IR and its role in their daily activities. The place of 4IR and agriculture in respect of their existing skills and knowledge as small-scale farmers was assessed, as was the affordability of the technology, and the capability of the farmers to purchase and operate these advanced agricultural tools. From the above table, it can be seen that some participants could not make it, due to personal reasons; but there were two additional members who assisted to fill the gap and shortened the process of data collections because they were available at short notice.

### 5.3.2. Table 6: Response Rate

	Actual size	sample	Responses obtained
Number of face-to-face interviews	24		24
Number of telephone interviews	4		4
<b>Total</b>	<b>28</b>		<b>28</b>

Sources: Author's creation (2021)

All the participants successfully participated as promised except for the two participants which were also replaced by two additional members. Farmers were very welcoming and pleased to share their daily routines and gave more information and permitted the researcher to take pictures of their product (agricultural output). Participants were available from the department of agriculture, Owen Sithole Agricultural College, Agricultural research council and opted to do telephone interviews based on their availability.

The six objectives of the study had sub-questions tailored to speak more directly to each participant; for instance, small-scale farmers had less information and knowledge on how the programmes are running in the department of agriculture. The participants were asked to answer six open-ended questions, which enabled the researcher to acquire more informative input from the perceptions and perspectives of participants. Involving different participants with different skills and knowledge about agricultural activities prevented the research from being biased. Responses revealed that there is a lot of dysfunctionality taking place between farmers and government officials (programmes). The research responses were analysed using themes and codes corresponding to the objectives below:

**5.4. Objective 1.** To assess the perceptions of small-scale farmers on the implications of the Fourth Industrial Revolution, and its benefits to their output.

First and foremost, small-scale farmer's interviews were conducted in isiZulu and then translated into English. The participants' knowledge and skills about the remarkable agricultural technologies were invoked by video clips prepared during interviews. This contributed to the smooth running of the interview process. It was very important to assess the background and individual understanding of the 4IR characteristics and also paint a clear picture of the difference between the previous and current technology (4IR). The implications of the 4IR and its contribution to the agricultural output speak a different language to different people, even within the same organisation (agriculture). As the first participant (small-scale farmer) specialising in poultry pointed out: *“even though the previous and present agricultural technologies were rightly introduced they were more commercially benefiting. As a result, the 4IR provides*

*technology-based advanced agriculture solutions to fulfil the current demand while also providing updated technology which is expensive for us as small-scale farmers. 4IR technical advancements can be applied to all aspects of existing agriculture, resulting in significant productivity gains in a variety of intelligent ways rather than a few, limited services”*

All the participants shared their views on the impact of the 4IR on small-scale farmer output. The manager at the Felixton Mill stated that: *the usefulness of the 4IR will depend on whether the technological tools are affordable, and it is also vital to remember this; the areas of KwaDlangezwa have old and young farmers which separate them in terms of their capabilities and keenness to the change. Lecturer at Owen Sithole also added that the notion of introducing technological transformation such as drones and driverless tractors and other 4IR technology is not a bad idea, firstly this change needs to be put into practice before full criticising it. As result, some machines will not properly work because of our landscape. The KwaDlangezwa area is made of hills and mountains which makes it difficult to be ploughed using tractors. On the other hand, using the old agricultural tools with the help of people and cows to prepare the field is still more beneficial and affordable for us as small-scale farmers at KwaDlangezwa.*

A participant comment that as some small-scale farmers, *“there some things that are no longer aligned or working because of age; this will train me to learn on how to operate machines while I do not even own a smart phone. An old female old small-scale farmer mentioned that there is not much gained from the output, purchasing the advanced tools will not be possible. I cannot even buy myself a sofa.... [laughing] as you can see our fields are not levelled to successfully operate the advanced tools also they are kilometres not hectares”.* From the Felixton Mill manager: *some small-scale farmers fly drones to monitor the sugar fields, but for big farms. The 4IR at hand is handy yet for some farmers expensive and not yet a priority, depending on their output and capability. For instance, farmers with small ploughing fields are not in much need of drones but rather had proper information on how to grow quality sugarcane with sufficient sucrose to earn more profit.*

A sugarcane grower added that *as black farmers we are not there yet, based on our output and if we can allow commercials to produce their output on a monthly*

*basis all the black farmers at KwaDalangezwa will not be able to deliver to Felixton Mill. Simply because the number of trucks allowed will be reached only by commercials, leaving small-scale farmers products to waste and loss. As a result, we will not benefit from the use of technology, and based on our output we will be forced to give away our businesses to commercials while the government claim that they are developing us. For both commercials and small-scale farmer's entrepreneurial intervention is important. Generally, small-scale farmers feel that commercial farmers already have full capacity for the use of technological tools. The fear of small-scale farmers is that numerous people (employees) will lose their jobs and be replaced by robots performing their duties on a daily basis.*

To add more on what was illustrated by the small-scale farmers, their needs are basically on the lack of funding, a sugar cane grower small-scale farmer; added that *“as we grow sugar cane, we are in need of funding to stabilise and maintain our product, as we wish to expand our business and employ more people. For black farmers, it is our strong belief and nature that employing people is a sign of being a good person in the community”*. A small-scale farmer further explained that *the introduction of the 4IR will not benefit small-scale farmers if its main focus is on producing more, rather than focusing on the persisting challenges and resolving them first before any attempt to develop small businesses including small-scale farmers*. The traditional leader (Inkosi), who is also a sugarcane grower, pointed out that *bringing big machines and expensive 4IR tools while the small-scale farmers are renting the old and outdated tractors is not an answer to their existing challenges*. A commercial farmer indicated that *the 4IR agricultural tools have, and will continue to, benefit them with a greater yielding output*. Also touched on that the ways of farming have changed over the decades and how it is essential to merge with and engage in transformation and change in agricultural activities. A science lecturer added that for instance, *the soil may not be monitored by the naked eye these days, but it needs to be tested and approved regarding its capability to accommodate a particular and specific type of crops using scientific methods*. Furthermore, small-scale farmers acknowledged that the use of agricultural technological tools is vital to improving output. More skills and knowledge are gained through practice and engaging with technological tools.

Controversially, a small-scale farmer specialising in vegetables and fruits proclaimed that *there is no need for the 4IR, for us we have been using our old and traditional ways to maintain farms. Over the past year's small-scale farmers have employed so many people from around KwaDlangezwa and outside the area. As a result, there is no point in using the new agricultural tools while the challenge of funding still exists.* The only thing working for small-scale farmers at this point is that they receive help from relatives, working without any payment but consuming food. Unless farmers may agree to work together, and collaborate / co-join their businesses in order to buy drones and other technical working equipment. The Department of agriculture official added that *having proper marketing and store/cold rooms has been a persistent challenge that needs to be addressed sooner rather than later.* It was stipulated by a small-scale farmer that *If there are small machines mainly for small-scale farmers at an affordable price they will benefit from the 4IR. The purpose of development and the multitude of outputs from the beginning has been a great idea but wrongly implemented, because most of the small-scale farmers have been struggling to purchase agricultural working tools - except for commercial farmers, who seem to be benefiting more from most of the government development.*

Challenges faced by small-scale farmers has led them into producing less in quantity and quality. small-scale farmers (black) have inadequate land and no funds to purchase the land and put it to good use. As a result, there are farmers with land but lacking funding to cultivate that land. Another participant (small-scale farmer) specialising in poultry, agreed that *small-scale farmers in poultry (KwaCaluza) will benefit from the use of the 4IR tools, and the machines mainly for monitoring animals will save most of the product. This will give a farmer the chance to prevent the foreseen disease and attend it at all costs for food security while serving the community. The disadvantage of the 4IR is that older people have no idea of its benefit and quickly disagree with the whole concept. They still rely on the use of old ways such as taking the cows (ediphini) poison to kill ticks as a way of protecting the skin of the animals and injection as the only form of protecting animals from diseases and enhancement of skills and knowledge about animals and seasonal breeding.* The agricultural college (Owen Sithole) Vice-Principal added that *“the community benefit from the finished product and also small-scale*

*farmers get a chance to engage with lecturers for the development of their skills as farmers. Lectures work with local farmers to advising them on ways to sustain their product". The participant from the Agricultural Research Council (researcher) emphasised that the organisation is effective and provides plenty of agricultural information even for the emerging farmers. The researcher added that "the information is given away and made available for those who want to gain agricultural knowledge and skills, but it also depends on the keenness of individuals and enthusiasm to enhance their agricultural activities. There are crop management projects supported by local government to design effective agricultural policies".*

*Even though participants shared their views on the use of 4IR and most small-scale farmers agreed on this concept of implementing 4IR in elevating the output, they were very concerned about the unresolved agricultural challenges before jumping the gun. Most of all the small-scale farmers voiced the opinion that they are not familiar with the old technology, so how will they adapt to this massive change without proper guidance. A lecturer in science and agriculture conceded that there is a lack of scientific knowledge among small-scale farmers not only at KwaDlangezwa but also in other countries. In order to operate these new agricultural technologies, one must hold a good understanding and background of both science and technology expertise. While older farmers prefer to walk around instead of flying drones one may not deny that they lack resources but most is manufactured in the name of the ones who can afford and benefit the economy most. Also, the market is still a big issue and the non-existence of contracts with retailers and the inadequacy of government funding/ bank loans.*

The use of advanced tools will be a great benefit and allow small-scale farmers to control their land /farms and weeds, thereby contributing to better yields. The technology has served and still does, as a good tool for greater output not only in agriculture but for all the organisations/corporations, but one cannot ignore the existing challenges preventing greater yields. As a result, before moving forward with the development of the country, strategies must be adopted, but in a manner that makes them more reliable and realistic regarding challenges faced by farmers in South Africa.

**5.5. Objective 2.** To evaluate the obstacles experienced by small-scale farmers while considering the elements that contributed to their experiences.

Agricultural activities are broad and wide in concept with regard to the history of agriculture and the role it has played in changing people's lives. Just like any other business sector in the world, farmers have experienced and are faced with different challenges and they try to rise above all existing threats and obstacles. One may argue that some of the challenges faced by farmers have been there for years and they have got used to them. At some point, farmers are forced to cope with some of the challenges. For instance, one participant (small-scale farmer) stated that *"there is a lack of transportation and marketing. They added that also as a small-scale farmer it is difficult to produce massive output because of inadequate input. From what is produced at the end of the day, it all comes from our capital (pension) which is not enough to purchase agricultural materials and also cover household needs. Selling our product at the roadside, without any customers except for community has made many of us as small-scale farmers lose hope that one day we, or even our next generation, will be commercial farmers"*. Small-scale farmers (participants) shared their concerns about the difficulties they face before and after their finished product. It was very important to assess their working tools at hand and take note of the extent of technology needed by small-scale farmers mainly at KwaDlangezwa. The commonly used tools and equipments were:

- *Igeja (Garden hoes), spades, wheel hoes, broad forks, seeds, trenching shovels,*
- *Tractors (hired not owned, Loli (truck) and Manyolo (fertiliser) which ranged between (R400, R500 and R600)*
- *Ucelemba (pang) to cut trees*

One participant (small-scale farmer) further elaborated on the process of planting sugarcane from start to finish. Firstly, from the above working tools, there is not even one agricultural tool that is slightly close to the 4IR technologies. After the farmer has decided to plant sugarcane, the first step is to cut trees using a pang, hire a tractor, prepare the soil and remove all the grass and other unwanted dirt. Again use the same tractor to divide and open lines while applying *manyolo* (fertiliser) to prepare the

soil, hire people to plant it, and when the sugarcane is above the soil then another fertiliser is used again to assist the sugarcane in growing. After that, the farmer hires people to take out the (*ukuhlakula*) weeds or opt for the poison to kill the weed, not sugarcane. In a nutshell, the pieces of mature sugarcane (“setts”) are planted using special machines which cut the cane into setts, drop them into furrows, add fertiliser and then cover the setts with soil. Planting with water at one litre per metre before covering is very effective in improving germination in dry soils. The participant from the department of agriculture (director) also shared the challenges they encounter when assisting small-scale farmers *“Our business cars are being stolen by some of the community members when we do site activities. On 31 March 2021, I was hijacked during a site visit. This affects our daily activities and as a result, some farmers have to be rescheduled and work with available transportation. Also, some of the small-scale farmers have been visiting our offices and asking for our intervention on the shortage of farming equipment, such as funding or giving away chemicals before their crops rots. Even though the department does contribute and distribute certain crops they are seasonal and there is a specific time when to give them away”*.

The director continued that; *“some farmers do not benefit much, because they need to wait on crops and other agricultural equipment’ to be considered while some crops are out of season. As a result, they become a waste. Also, the distribution of fertilisers should be in line with certain crops otherwise they will not serve their purpose. The overdose of fertiliser also destroys or damages the soil, which some the small-scale farmers are arrogant about and ignorant of taking care of such instances. As far as the department goes, small-scale farmers are urged to test soil which cost as little as R120 once in a while”*. The participant continued that there was one encounter that took place where - 20 000 cabbages were damaged and farmers took them to *“Gingindlovu because there was no proper market and fixed contract with retails; farmers were used to selling their product for the cost of R15 and R11. They struggled to sell their product at a low cost such as R7 per cabbage. Even though there is a Durban market transporting the product on its own is was a challenge. There was one instance where the agricultural department decided to build a cold room as storage at Nkandla but the place was not properly built to serve its best purpose. The cold room was meant to store cabbages, but the infrastructure was built like a hall, with no place to put and store the product according to its grade, and the place was hot instead of*

*cold. This type of product should not be kept in a hot place after harvest. The director at the department of agriculture continued that the plan was to contribute to rural development, but the place had no tables and the temperature was not monitored; there was also no compartment and no uniforms for the farmers. The infrastructure was supposed to be aligned with the SA Gap certificate and also encourage small-scale farmers to get such certificates to open more marketing doors”.*

*Moreover, the director specialising in plants shared this view: “I want to see small-scale farmers becoming more and being motivated to strive and continue to serve people. I love my job and I hope that one-day small-scale farmers will become commercials. Small-scale farmers are capable of becoming more, just that they need stability and do more for themselves after receiving the basics from the department of agriculture. With the skills they have, they are capable to manage big farms and also liaise farm”*

*A participant (traditional leader, small-scale farmer) also touched on the challenges faced during and after harvest: the working machines are not protected, sometimes they are stolen and not adequate to cater to all of us at the same time. As a result, harvesting is done through the availability of tractors and trucks not when the farmers are ready to harvest. After harvest, there is no proper security for sugarcane at the storage piles. The challenge is that sugarcane should not be stored in wet and warm weather because it accelerates deterioration. The same output is packed in an open space with no shelter, exposed to people stealing it. The small-scale farmers share transport (tractors and trucks) since they do not own any of the machines.*

*The participant from the Research Council (researcher) stated that in 202 there was a youth Indaba, addressed the issue of land and crop among small-scale farmers which brought stress due to lack of support from the government. The people that will benefit from the 4IR are already well connected and have knowledge about agricultural technologies. The commercial farmers are fully engaging in technology as they monitor their fields using drones and other related agricultural tools. A participant from Felixton Mill (advisor) added that small-scale farmers do not have stable and reliable transportation, as a result, they end up hiring any trucks. The advisor continued that “Felixton Mill accepts 39 trucks a day. The delay of transportation negatively affects*

*the quality of sugarcane and results in less profit. Vegetables and fruitsellers commented that, there is no proper marketing. A small-scale farmer selling fruit and vegetables touched on the fact that product is sold under the trees. "With the same amount received I have to take care of 4 kids, the elder ones are not working. I have 3 boys and the last born is disabled. I am not making any profit since we also consume the product. Another participant (poultry) added that they purchase fertile eggs from Pietermaritzburg and that hazonke store which supply with fertile eggs and they keep them in an incubator until they are ready to be sold".*

*A participant from Felixton Mill (manager) declared that "At the moment we are not owning any trucks; farmers have their own arrangement. Our job is to advise people on farming - only to find out that they lack funding. When the sugarcane farmers produce inadequate output this delays the process of processing sugarcane into a final product to be distributed to different retailers. As a result, sugar prices rise because of its importation. Also, another challenge is that small-scale farmers have little information on how things work inside this business, such as when and how to produce their products. Felixton mill is open for 39 trucks a day - any that come after that cannot be considered. Also, there are complaints about not making much profit; the issue is that sugarcane is meant for a specific chemical or fertiliser. Once, unwanted chemicals are applied or used the sucrose will be less. Lastly, the contractors are not doing any justice to small-scale farmers because they take time to collect sugarcane from where it is stored. It travels a longer distance and when, finally, it is there, the product has lost its quality while still good in quantity. The sugarcane takes one year to grow, and before the process of harvesting takes place there is a ticket which is granted by the chief to allow small-scale farmers to harvest their final product.*

*Commercial and small-scale farmers can also pick up the ticket from Hulett which costs R500. The truck needs 7 loads before delivering to Hulett. Also, since small-scale farmers at some point fail to produce the required load per person, what they do is that they put together their product and split the money among themselves afterwards. Lastly, as previously mentioned, small-scale farmers struggle with transportation, they are using old machines, which can lead to breaking down at any*

*time, and even catching on fire sometimes. The same transportation waits at the side of the road with the product. All these instances negatively impact their profit.*

**5.6. Objective 3.** To explore extensively the government and stakeholder's financial support in small-scale farming.

The government investment in commercial farming services has focused on the sector's efficient expansion, such as rural infrastructure, basic research, and disease and pest management, while also aiming for a higher rate of cost recovery for government-provided services. Because of the fierce competition among alternative claims on public funds, the government and stakeholders must demonstrate what they are seeking and receive value for money if they want to continue to make a solid case for agricultural expenditure. Moreover, the funders must ensure that monies are not only used for high-priority goals but also that the most efficient means of achieving targeted people objectives are identified and attained.

*A commercial farmer believed that when the government decides to fund a specific service, it aims to encourage the most cost-effective providers of that service, and must be willing to outsource service provision in a transparent manner to do so. There is no reason to believe that a public-sector organisation has a permanent monopoly on the function of service provider: this privilege must be won by effective performance and serve its main purpose.*

*Agriculture remains one of the largest employers worldwide. Small-scale and commercial farmers are always critical to each country's food security and economic stability. The commercial farmer continued that: what happens when property and fortune are not enough to keep the lights on? Farming is broad. As a result, government and stakeholders' interventions and support have been of great assistance. One may agree that farmers all over the world face difficulties when it comes to maintaining their farms. As a result, the government and stakeholders have indeed helped with financial support. Land issues and disputes have been also covered by the government. There are farmers who are still struggling with land, but*

*all those cases are under government attention. The participants were asked if there are any farming programmes, training and workshops available to enhance small-scale farmers' skills and knowledge. The participant from Felixton Mill (Manager) stated that there is training at Skhawini and Mpembeni to educate farmers taking place occasionally. Moreover, each area has an advisor who makes sure that farmers are well-taken care of. The advisors also added that the attendance is good; farmers are willing to grow and use available information and tools. Farmers avail themselves and they learn a lot from the agricultural meetings. That is when they learn more about the importance of food security and other matters relating to their product. Even though the attendance is good the organiser needs to ensure that the date must not clash with the day of pension pay-out. The director ended with the disclosure that Felixton Mill does sponsor farmers with crops and working tools.*

Through the Comprehensive Agricultural Support Programme (CASP), which began in 2004, the Department of Agriculture has pursued a commodity-based approach since 2009 (Public Service Commission 2011). A federal government effort aiming at aiding provincial agriculture departments (PDAs) in creating a favourable environment for new farmers and extending the provision of agricultural development support services, the CASP has been used as a government tool for providing post-settlement assistance to targeted land reform recipients and other producers who have bought a property through private methods. The CASP is based on the following principles:

- *Value chains, as specified in the Agriculture Policy Action Plan, are given priority (APAP).*
- *Making full use of collaborations to capitalise on the strengths of crucial private-sector partners.*
- *Funding for land reform initiatives.*
- *Market access and the possibility for employment generation.*
- *Providing farmers with a complete support package.*
- *Assistance to small-scale farmers in the form of mentoring.*

The director from the department of agriculture, gives away items of working equipment, especially when there are meetings with the Member of the executive council (MEC), such as hoes(Amageja), which are mostly used by small-scale farmers and employees. Moreover, farmers are taught how to monitor and maintain horticultural hand tools that are used to shape soil while eliminating weeds, clearing soil, and harvesting root crops. Also, the department of agriculture supplies small-scale farmers with watering cans and seasonal seeds. The department will also focus more on these programmes as a core developer for the department and will make interventions in six priority areas:

- ✓ Information and technology management
- ✓ Technical and advisory assistance, and regulatory services
- ✓ Marketing and business development
- ✓ Training and capacity building
- ✓ On/off-farm infrastructure and product inputs
- ✓ Financial support

The above programmes will cover and address agricultural challenges while working on aligning with the vision and mission of the Department of Agriculture, Forestry, and Fisheries (DAFF). Hence, the programmes will play a vital role in educating farmers on agricultural technologies (4IR) and the implications for the whole idea of enhancing agricultural activities. As for small-scale farmers, they emphasise the necessity of increasing the output to a level equivalent to input. For farmers to access all the required inputs they need assistance from the government and stakeholders. Another director in plants shared the information that for sugarcane growers the use of a tractor is handier when preparing for ploughing. “I have worked with Nkandla small-scale farmers, and the experience was quite different. For instance, small-scale farmers at KwaDlangezwa are owning fewer hectares (HA) compared to farmers at Nkandla”. The organisation does reach out to small-scale farmers and as community engagement allowing farmers to participate in any community development. The department also works with a residence chief to distribute working tools, but this is not always the case”.

A participant (small-scale farmer) further expressed the view that “ever since I started with this business selling vegetables and fruit under the trees, I have never

*received any direct financial support from the government". Government support and all stakeholders support is insufficient because I started my poultry business a long time ago and I am grateful to my loyal customers (community members). I guess the financial support is only received by certain people who are well known".*

The importance of shareholder involvement and support in small-scale farmers increases the produce because farmers get to purchase more of their agricultural input. Felixton Mill manager and Department of agriculture participants (directors) emphasised that *as an organisation working with small-scale and commercial farmers it is our duty to provide them with all the necessary assistance to enhance their product. Apart from the challenges faced by farmers, there is an issue of grazing for farmers specialising in vegetables and fruit in the KwaDlangezwa area.*

*The areas meant for planting are not fenced, and animals walk around and eat the product because they are not under supervision. This has caused many community disputes between farmers and non-farmers.* Another participant stated that it is not possible to plant and also keep animals on the same piece of land. The youngest small-scale farmer shared that: *"in 2020 there was a training at an Owen Sithole College workshop on the reproduction of chickens. These kinds of communications and information are out there, but not all black farmers attend such events. The support from the government and stakeholders is made available for all of us as emerging farmers. In 2019 I wrote a letter to the department of agriculture, a request to start my own business, and they agreed to assist me but I need proper land and space to keep 100 cows."*

**5.7. Objective 4.** To evaluate whether the 4IR technologies can assist the agricultural output and agricultural organisation at the KwaDlangezwa area.

From participants' perspectives, there are challenges faced by farmers and other organisations working hand in hand with them. Some small-scale farmers have expressed their concerns about the introduction of the 4IR. Other small-scale farmers have agreed that they will benefit from the use of agricultural technologies, while some have disagreed. *Furthermore, it is essential to get more information on whether the 4IR agricultural tools can eliminate the challenges faced by small-scale farmers and how.* With the help of a video clip that was played to illustrate some of the machines

not yet introduced in South Africa farmers were able to reason and respond based on what they saw.

*A participant shared that they still rely on word of mouth, and they pay less attention to technical assistance to monitor their fields, such as when to prepare for input. August and September are the perfect times to plant sugarcane, but the weather is not predictable as to whether it will rain as it normally does seasonal. With the help of Artificial Intelligence, Big Data analysis used for internet/marketing purposes and AI – Machine testing for soil and weather conditions, small-scale farmers will gain more compared to what they have achieved previously. A participant (small-scale farmer in poultry) maintained that in a week there are 500 chicks purchased and kept under incubator monitoring until they are ready to be sold. With the help of advanced technology, the business has doubled its produce. Even though the supplier is based in Pietermaritzburg the business is doing well.*

On that note, incubators are one of the ways to grow chicks, but they vary in size and price. Instead of using one of the old methods to keep the place warm, incubators are a great tool to produce a pleasing outcome as they start at as little as R 3299.99 and accommodate 48 eggs and go up to R 88000.00, accommodating 6000 eggs. A participant (worker at the farmer) shared how advanced technology has made things easier for them in the field. A participant specialising in cows and goats added a comment on the importance of technology *“For a typical example there are cases where a customer orders a certain breed that we do not have. As a result, we have to place an order only to find out that the customer cancels the requisition at the last minute. The same breed will wait for someone who will be interested in purchasing it.”* One of the participants (small-scale farmer) also applauded the idea of technology by adding that *“word of mouth is an old way to reach customers, but now customers can search our place and see our product and also do follow up when necessary. Even though the funding has held us back from growth lots of things have changed over the years and all thanks to the technology”*.

One of the participants (small-scale sugarcane farmer) stated *that people are hired to work in the field and they get paid based on the hours they worked, not the work they covered from each day. As a result, workers do little work per day and drag the process*

*out while they are not performing at their best capacity'. With the help of driverless tractors and drones, as a farmer, the daily duties and activities will be covered without paying so much to different people. Moreover, the advancement of technology will maybe assist in the innovation of the old transport (trucks), because the same and old trucks that were used by the previous generation are not reliable to travel long distances anymore.*

*A lecturer in science also emphasised the soil erosion challenges and acknowledged that with the help of AI-Machine learning most of the fields will be fertile and accommodative to seasonal ploughing. Animals and tractors also affect the soil - something which most small-scale farmers are not aware of. The changing of ploughing yearly helps the soil to recover since different products demand different fertilisers. Most farmers could not well articulate the use of technology because they did not own many of the agricultural tools, rather relying more on old farming tools. They had more ideas and a clearer picture after they saw videos on the 4IR agricultural technologies. Even though they are sceptical about a huge change, based on the challenges they face every day, this was an eye-opener to available alternatives in agricultural development.*

**5.8. Objective 5.** To assess the extent of small-scale farmers' skills and knowledge on agricultural technology tools and Agri-tech at KwaDlangezwa.

From the above objective and responses, it was clear that most farmers, especially the ones that were old, did not have much experience on the importance of using 4IR technologies, which is linked to objective 5, assessing farmer's skills in Agri-tech at KwaDlangezwa. It's not always clear which technologies are viable for the development of farming and which agricultural practices will contribute to long-term sustainable farming systems. A small-scale farmer pointed out that previously, *research was primarily focused on solving technical issues; currently, it is focused on identifying research objectives and the appropriate technologies to meet present and future societal demands. Biological pest management, biotechnology, information technology, bioremediation, precision farming, and integrated and organic agricultural systems are among the top goals of the department of agriculture. However, a small-*

scale farmer shared common concerns such as the educational and training system, institutions, and the relative role of public and private research endeavours. Furthermore, some sustainability challenges can be handled without resorting to technical solutions by simply altering the volume and type of agricultural production as well as its location. Traditional and modern technologies, particularly those relating to biotechnology, informatics, and precision farming, are worldwide enterprises. Those technologies are frequently disseminated within the national market, but their application is limited. However, the consequences of farm-level adoption on long-term sustainability extend beyond the farm. More vertical integration, whether through formal ownership structures or contractual relationships across the whole food chain, means that decisions on technology adoption at the farm level are frequently inextricably linked to decisions made elsewhere in the food chain.

A commercial farmer added that technology evaluation for farming systems from a sustainability standpoint is still in its infancy. Until recently, the effects of farm technology were judged using only a few, generally well-defined, and measurable criteria: production, productivity, farm incomes, employment, and trade. When environmental, social, and ethical issues must be taken into account, determining sustainability becomes increasingly difficult. It's not always clear how the various elements of sustainability interact, what should and can be measured, and how the results should be interpreted so that farmers, policymakers, and other stakeholders can determine with reasonable certainty which sustainable technologies work, which channels can best facilitate their dissemination and adoption in various conditions, and at what cost and benefit.

One small-scale farmer stated that some farmers do use APPs for climate change and they are knowledgeable about such. "My educational level is standard three, and there not much I could do with such education at hand before and now. As a result, I decided to have my own small business. My farming skills did not require education. From the time I was a little girl my parents worked for commercial farmers. The same skills and knowledge were passed to us and I am grateful for such experience. Education is a key to success, sadly at home, we never had that chance; but it also important to have a

*basic understanding of things taking place around the world especially as small-scale farmers; our farming journey has been rough and hard.*

*The Director at the department of agriculture also mentioned that there is so much for farmers, such as producing more to be distributed into local big retails. On that note, a small-scale farmer added that “my main concern is that these machines are costly and more advanced for someone like me who is used to Spade, shovel, hoe (igeja) wheelbarrow, watering can and other portable tools. On the other hand, with these working tools, as farmers, we are able to share them and borrow from each other, so tell me, how will they agree to share their drones and other technological tools”. Moreover, farmers were asked if they have permanent /temporary employees or family labour and why. Most small-scale farmers selling fruit and vegetables, sugarcane growers and poultry farmers emphasise that their business started years ago, some as legacy and some started at a very young age. As a result, they are used to receiving help from relatives to eliminate expenses.*

The commercial farmers, they had both permanent and temporary employees. One commercial farmer added that “There are permanent employees even though Covid 19 has disrupted the way we used to work. Because of the restrictions and social distancing some of the employees were asked to stay at home and come to work occasionally”. There are also temporary employees, where the focus is on hiring foreigners to give them a chance to share their skills and knowledge with us. The youngest farmer of all the participants stated “when I grew up cows were much cheaper. At the age of 16, my father bought me cows and I had to be fully responsible for farming”. Young farmers have different knowledge and skills from what has been done wrongly in the past and have a greater chance to do better by adopting technology and assisting older farmers at KwaDlangezwa.

**5.9. Objective 6.** To propose novel agricultural policies, frameworks and proposals for small-scale farming sustainability.

Agriculture in South Africa plays a critical role in developing a robust economy and, as a result, reducing disparities by raising incomes and employment opportunities for the poor, while protecting our natural resources. However, even though

the government tries to resolve the agricultural challenges that still exist and hinder a speedy resolution. Commercial and small-scale farmers agreed that *the international and regional venues play an essential role in our industry reform as a sector that is increasingly heavily involved in international trade, speeding exports and effectively competing with imports, with reasonable tariffs and other restrictions. Thus, our land and agricultural policies are meant to enable this diversity of output in order to reverse the purposeful policy annihilation of black farming in South Africa over the last century.*

*The Director of the department of agriculture shared the view that some of the challenges faced by the department are that agriculture is broader in rural development processes that include land reform, water supply and transportation infrastructure investment, and increased social service delivery. For the past years, the evictions of individuals living on the property, farm murders, and abuse of farm employees are all examples of the rural areas' deep-seated instability. Agriculture that is prosperous and built on cooperation and teamwork will help to alleviate insecurity and dread.*

*Commercial farmers emphasise that, just like any other country in the world, South Africa has highly depended on farming /agricultural produce. Agricultural activities have positively impacted people's livelihoods in terms of employment and owning business internationally. As with any other business sector, government interventions are imperative to control and monitor industries. Policies, mainly for business also apply to small-scale farmers. This protects customers and assist in a form of development. The perceptions of participants on agricultural policies have stressed the importance of supporting small-scale farmers, not only financially but also in securing their possessions, i.e. their land. A participant (small-scale farmer) stated that "the agricultural policies are not in our favour as black farmers, continued that the land policies must help black emerging and small-scale farmers all over the world. The issue of land has been the discourse, and till today, most developing countries are struggling to resolve such issues".*

*Another small-scale farmer added that the problem is that, apart from the issue of land, as small-scale farmers, we are restricted and do not have access to bank loans*

*because of the low turnover. Financial assistance can help small-scale farmers develop and expand their businesses. The restrictions on loans at the bank can also be resolved by the government focusing on small-scale farmers. "From my perspective Nedbank and Ithala bank should assist black farmers." On the other hand, a sugarcane grower added that "at this age, I am looking forward to selling my farm, simply because I am too old to maintain my farm activities. For me, there is no need for more land while I am struggling to maintain this one. Even though the issue of land should be addressed, as it is long overdue, and clearly the next generation will suffer and fight the battle over and over again". Small-scale farmers in fruit and vegetables stated that, based on the product produced, there is no need for more land, because it will be left unattended and not cultivated. However, it is the issue of markets that has been persisting, and lack of financial assistance from the government. Yet there are policies mainly for such activities but they depend on who is responsible for distributing the funds.*

*A community member mentioned that for years, small-scale farmers have been challenged by ownership of land and lack of financial assistance and reliable markets. Another worker made an example that most of their product fails to reach the target requested by retailers and they have no proper market. On the other hand, it is very important to have more focus on small-scale farmers, as they assist in job creation. One might suggest, for example, that farmers from KwaDlangezwa form a cooperative agricultural business, but that will not be possible without farmers initiating it and showing that they are keen to so do. A participant also focused on the fact that government policies on land, finance and markets side-line small-scale farmers and only serve big and commercial farmers.*

*A small-scale farmer shared the view that, seemingly, commercial farmers are already benefiting from policies that were initiated years ago, and today it is hard to change those policies and take the land back since the government benefits from it, such as its contribution to the GDP. Government policies and restructuring of policies have turned out to be lacking their main purpose. Some farmers receive land back, but they lack funding. As a result, land back without a proper plan or capital creates havoc because people are selling the same land to other people at a lower cost. Participants' views on agricultural policies brought more insight on what*

*should be considered as new policies on small-scale farmers at KwaDlangezwa, KwaZulu Natal in South Africa. The most important aspects to be addressed are:*

- ✓ Farmers lack support and access to land, markets and financial assistance, the department of agriculture participant stated that “in 2019 I had to lease my place because I did not get money for 5 years”.*
- ✓ Farmers are hesitant about leasing their farmers, instead, they sell their property, which is a loss for their development.*
- ✓ Banks are not accommodating about helping, as emerging and small-scale farmers are in need of funding.*
- ✓ There are no policies on natural disasters and climate change.*

*Law and policies on the distribution of funds should be tightened. Also, the land is a crucial matter to be attended to by government officials. In South Africa, it has been claimed that developing markets for smallholder farmers can significantly attract them into mainstream formal marketing.*

*Small-scale and commercial farmers added that land reform, which was designed as a tool for the development of the rural poor, has had little impact on black people. Effective land reform is one of the most effective strategies to reduce inequity and boost small-scale farming output. The promise of leveraging 4IR to achieve agricultural sustainability through the transformation of small-scale farming systems has dominated public and policy conversations in the country. Participants, share the common thought that the development of agriculture in South Africa is often viewed solely in terms of the technical advance, in this century particularly, of large-scale commercial farming specialising in crop and animal production according to the prevailing natural resources and climatic conditions, and taking advantage of both abundant low-cost labour and opportunities for mechanisation.*

*This viewpoint holds that agriculture can only contribute to the economy through a concentrated production system like the one already in place. As a result, they feel that small- and medium-scale agriculture, which is built on diverse output, family labour, and inferior technology, has nothing to offer in terms of aggregate production and farming revenues.*

## CHAPTER SUMMARY

This chapter was mainly concerned with presenting data that was collected from interviewed participants who were the subject of the study itself. However, it was important for this chapter to firstly touch on the background “*The Place of Fourth Industrial Revolution in Small-scale farming at KwaDlangezwa, Kwazulu- Natal, South Africa*”. The study not only focused on small-scale farmers but also on the department of agriculture and the universities that offer agricultural courses. The involvement of more people, with direct and indirect engagement with farming activities, contributed to the study obtaining more information that was not going to be gathered by only interviewing small-scale and commercial farmers. All six objectives were addressed by participants. Also, their answers were honest and based on their experiences and views on the 4IR. The participants showed interest in the topic and asked questions where they did not understand the concept of the study. From the results, it clearly illustrates that small-scale / commercial farmers’ experiences and challenges differ from category to category.

Moreover, there is a huge difference between the experiences reported by government officials and farmers. Even though the department of agriculture’s activities and programmes are made available for farmers, some challenges remain, such as land, markets and the issue of funding; however, farmers are well aware that there is more to be done for proper rural development. As a result, their view on the 4IR was based on the belief that the idea of change and transformation is good but the implementation of such without addressing the remaining challenges will continue to sideline the small-scale farmer.

The results also revealed that small-scale farmers were willing to adopt and adapt to the idea of using 4IR agricultural tools. Yet, there are concerns about how will they purchase such advanced tools. Again the findings showed that even though the department of agriculture assists with agricultural basics there is still more to be done by the government, including restructuring agricultural policies to fully and successfully serve their purpose for both small-scale and commercial farmers regarding equality. Also, it should be noted that the involvement of the small-scale and commercial

farmers themselves is vital the persisting challenges are to be addressed and resolved. Adopting advanced agricultural tools from developed countries has left many developing countries struggling with inadequate funds to purchase such technologies. South Africa is also capable of formulating and implementing what is most suitable for small-scale and commercial farmers after considering their challenges individually and factual challenges they face as farmers.

This chapter also revealed that even though small-scale farmers are experiencing challenges they are able to provide for their families on a daily basis and take care of other household financial expenses. The results also indicate that both commercial and small-scale farmers have pushed through all difficulties and made it this far, regardless of the existing obstacles. In this chapter, the participants shared their thoughts on what needs to be done before implementing agricultural strategies and developments. In the following chapter, the main focus will be on the results in chapter five, which are findings of the study objectives.

## **CHAPTER SIX**

### **DISCUSSION OF FINDINGS**

#### **6.1 Introduction**

Over the past year's agriculture has introduced many ways of farming as agricultural development using technology; as a result, there are the 4IR technologies after the 1<sup>st</sup>, 2<sup>nd</sup> and 3<sup>rd</sup> revolutions. The developments in industries have been a prodigious tool in sustaining businesses, including small-scale farmers at KwaDlangezwa in KwaZulu Natal. However, even though there have been changes and transformations in different companies, the agricultural sector has undergone difficulties and challenges, some of which have been resolved by the government and stakeholders. On the other hand, some persisting challenges have impacted agricultural output, not only in South Africa but even in developed countries, which are still being held up by some of the agricultural challenges. New technologies, such as artificial intelligence, automation systems, and cloud computing, have been developed to bring the digital and physical worlds together in the fourth industrial revolution (Industry 4.0).

One of the advantages of Industry 4IR is that it creates a crossroads for machines, infrastructure, and digital platforms (Saunila, Nasiri, Ukko, and Rantala 2019). In the field of agriculture, the methods of Industry 4IR have been examined, such as sensors, machine learning, wireless communication, positioning systems, and data visualisation tools, all utilised to add value and boost productivity in the agricultural industry (Braun, Colangelo, and Steckel 2018). As for this chapter (6), it is important to discuss the findings/ results laid out in Chapter 5. Predominantly, this chapter discusses the results from the previous chapter but merges it with capability and classical/ political theory while revisiting the particular literature on agriculture. The discussion of results is established from the six (6) themes of the research questions.

## **6.2. Theme 1. The 4IR implications for agriculture.**

From the first theme, it is imperative to reconsider that, from the 1<sup>st</sup>, 2<sup>nd</sup>, 3<sup>rd</sup> and 4<sup>th</sup> revolutions there has been a great impact in production from different private and public sectors. This has brought mixed emotions to different farmers as they have different daily experiences and challenges in the agricultural sector. The results from participants revealed that even though farmers are under one umbrella (agriculture) not all precision farming uses information and technologies such as GPS, satellite imagery, control systems, sensors, robots, variable rate technology, telematics, software, etc. at KwaDlangezwa.

According to the findings, small-scale farmers, in order to improve crops and increase yields while reducing harvest times, only used what they had and previously been fully dependent on, such as homemade fertiliser from decomposed things. Some supported the intervention of the 4IR characteristics such as the capacity to adjust the speed of driverless machines and tractors through cloud-based platforms to fertilise, plough or harvest fields, while locations are monitored. The small-scale farmers also revealed that they are more comfortable in using their old ways in maintaining their farms; they made an example of the tools at hand, such as pangas (igeja) to plant. As for the Felixton Mill, participants indicated that both commercial and small-scale farmers would benefit from the use of drones and other relevant agricultural tools, depending on their finances.

Also, the findings revealed that farmers fully accessing advanced technology will allow expansion of their businesses and also allow them to learn more skills regarding agricultural activities. From the findings, small-scale farmers shared that they are challenged by their landscape at KwaDlangezwa, land which is not very suitable for driverless tractors. As a result, they still prefer using the old ways of farming, hiring people to take care of the whole process from an input up to the agricultural output. Farmers also shared their concerns about using technological tools to perform the tasks that people previously performed, which implies that employees may eventually not need to be hired. This is supported by Ponnambalam, Fentanes and Gjevestand (2020) who state that all functions in future will be controlled by a central artificial intelligence. Peace (2017) also agreed that the use of GPS locations can be stored in the cloud to provide historic information of how crops change over time in specific locations. The farmer's

attention could be centred on areas where specific interventions are needed instead of applying techniques and products to the entire crop.

According to the findings, sugarcane growers have mastered the seasonal time of planting sugarcane, but one cannot deny that the issue of climate change has an impact on agricultural productivity. Silvestre and Tirca (2019) believe that Artificial Intelligent (AI) will boost knowledge and modelling of prospective weather and climate prediction and reaction analytics, as shown by climate action. Precision agriculture will allow farmers to detect crop illnesses early, increasing output and allowing them to escape rural poverty. In vertical farming, climate control systems and hydroponic technology help to reduce water, land, and nutrient requirements. Sensors, artificial intelligence, robotics, and drones all help to cut greenhouse gas emissions, establish crucial eco-systems, and encourage nature and water conservation (Mishra & Haheshwari 2020). With so much information at hand, farmers are in great need of the 4IR characteristics and education training them on how to utilise these technological tools. As the findings of the study further revealed, only one farmer, from the participants at KwaDlangezwa had matric, while the rest had primary levels grade 7 (royals) also called standards.

According to the findings of the study, small-scale farmers; touched on the need for more land, and questioned the need for agricultural development before resolving the existing challenges at hand. As observed by Lepheane (2017) the agricultural landscape in South Africa is dominated by large-scale, primarily white farmers. As a result, South Africa has a de facto bimodal agricultural system, which was exemplified before 1994 by the state's intervention in the sector through the provision of subsidies to commercial white farmers. The 1913 Natives Land Act, the Development Land and Trust Act 18 of 1936, the Group Areas Act 36 of 1966, and the Black Homelands Citizenship Act 26 of 1970.

According to the findings, the farmers at KwaDlangezwa found it difficult to understand the implications of the 4IR besides its being a threat to what they have built and sustained for themselves over the decades. However, Conradie, Piesse, and Thirtle, (2009) have a different perspective on the developments of agricultural productivity,

namely, that it provides advanced techniques and improves agricultural productivity both in developed and developing countries.

For instance, the findings of this study revealed that the participants from different organisations agreed that the 4IR has not been correctly introduced to farmers and, as a result, farmers and other organisations will be hesitant to adopt it easily. Malan (2018) supports the view that even though the (4IR) offers new ways to manufacture, grow, market, and distribute food in South Africa, as well as new solutions to address the issues that small-scale farmers confront, there is a need to revisit the remaining challenges that the previous revolutions failed to resolve. Research has proven a link between digital development, small-scale farmers' livelihoods, and poverty reduction; digital development can increase farmers' capacities and livelihoods (Mago & Mago, 2015).

Understanding technology necessitates an understanding of its practitioners' knowledge, abilities, routines, institutions, and practices, both individually and collectively. The reconfiguration of relationships among people, objects and artefacts, materials, and biophysical environments, the redistribution of agency through task reorganisation and reconfiguration, the reformation and reconfiguration of social networks and institutional arrangements, and the acquisition or development of new technologies are all factors that influence technological change ( Mago & Mago, 2015). The development and diffusion of new technology are often seen as vital for increasing productivity and ensuring long-term sustainability and resilience of small-scale farming systems in developing countries (InterAcademy Council, 2004).

The findings further revealed that, specifically, small-scale farmers are not fully aware of the 4IR agricultural technological tools, and report negative experiences on the use of technology. For a typical example, older farmers shared that they are more dependent on their old and natural ways of farming. They added that they started their business not out of passion but to survive and take care of their families; subsequently most business requires educational skills which they have not acquired. As Leeuwis and Pyburn, (2002;) and actor-oriented Long, (1989) added that the developing countries lack research institutions that are more scientific research institutes in order to understand the factual and direct challenges they face. In the study, a young farmer specialising in poultry mentioned that technology has played a

a huge role in their family business and the 4IR conveys hope that the farm business will expand and produce more because of the technology at hand. Even though the same technology seems to be more beneficial to the big sectors, there are small tools accommodating small-scale farmers. The farmer also touched on the issue that there is a possibility of older farmers denying and being resistant to change, but with the presence of younger farmers, the business will benefit exceptionally.

The findings of the study revealed that small-scale farmers at KwaDlangezwa find it difficult to adopt the 4IR technologies because of financial constraints. Moreover, according to the findings, farmers suggested that there is a need for carefully designed agricultural research to present such changes to farmers rather than presuming acceptance. Furthermore, the findings revealed that there is a need to involve farmers in any transformation and change as a sign of acknowledgement and appreciation that they represent a diverse set of biophysical resources, including raw materials, tools, equipment, machines, energy, constructed environments and different infrastructure.

According to the findings, the adoption of appropriate irrigation technologies will not only increase food production but could improve the income level of actors in the value chain. The responses came from different places and experiences, such as government officials, lecturers and other experts in line with technology and agriculture. Moreover, the findings showed concerns over the use of technology, while on the other hand, the young farmers were more positive about the implications of the 4IR. The study aimed at filling the gap and discovering innovative ways of reaching out to small-scale farmers at KwaDlangezwa; because in actual fact the information is out there for the development and sustainability of agriculture but it lacks the appropriate platform to blossom.

### **6.3. Theme 2. The obstacles experienced by farmers**

Like any other business around the world, there are challenges faced by small-scale farmers. Even though farmers have worked hard in pulling through and rising above such circumstances it does not take away the existing challenges. The study

revealed from its findings that the participants (commercial and small-scale farmers) point out the following frustrations instigated by challenges such as:

### **MARKETING**

- ✓ *There is no proper marketing platform for farmers that are producing vegetables /fruits and poultry except for sugarcane growers who supply for Felixton Mill. Small-scale farmers are not aware that in order to sell their produce to big retailers (Spar, Shoprite, Woolworths, etc) they need to possess an SA Gap certificate.*

### **FUNDING/ FINANCIAL ASSISTANCE**

- ✓ *Both commercial and small-scale farmers are not supported financially, which impacts and restrict them from growing their businesses. Even when they request bank loans, more especially small-scale farmers, they are restricted because of their turnover.*

### **LAND ISSUE**

- ✓ *This issue in particular has been fought by our grandparents, it is not something new; farmers have tried to deal with it over past years. Even the government attempted and failed to resolve it. The land issue should be resolved firstly by revisiting and restructuring land policies in South Africa to accommodate SA citizens, and successfully call it rural development when everyone benefits from the land.*

### **STILL USING OLD WORKING TOOLS**

- ✓ *Even if the 4IR cut through all business sectors, farmers at KwaDlangezwa are still using old working tools. They are more comfortable purchasing more instead of trying the new technological agricultural tools. This is also the result of affordability. The department of agriculture and Felixton Mill are giving away old tools. This is a sign that the newly introduced tools are handy for the individual that can purchase them and utilise them for greater output. The department of agriculture and Felixton Mill distribute Fertilisers, Panga(igeja), and Crops/seeds which are available seasonally. In what the*

*government and stakeholders give away there is nothing close to 4IR agricultural tools.*

### **TRACTOR HIRE PROCESS**

- ✓ The is a lack of ownership when it comes to agricultural machines. The tractors are under the control of the community leader (Induna). Small-scale farmers hire tractors and trucks for harvesting and ploughing. KwaDlangezwa sugarcane growers know the procedures to be followed. One of the small-scale farmers asked *“Seeing that we are failing to purchase the old tractors, how will we possibly buy the new ones? Is the government going to assist us? I doubt that will ever happen! I guess it is better we continue with our old tools and make that little output to chase away hunger, not be commercial farmers one day..... [the participant sighs].”*

The above findings were narrated exactly w by participants, and are supported by Warren (2004) who is of the opinion that farmers could make more profit if the challenges in marketing food, transportation, and financing are minor, and they could also open up their fields to domestic tourism. Farmers must have access to the internet and other technology in order for this to work. Most small-scale farmers are in remote areas and they are not good with mobiles or technological gargets. According to Boros-Papp & Varallyai (2019), the government and private telecommunications firms can help by ensuring that rural communities have access to fast and dependable internet. According to the findings of the study, the gap between small and large farmers can be narrowed if sufficient access to technology is provided by technological participants and the government.

According to the findings, there are solutions to the existing challenges. It is the duty of farmers and the government to work together and harness technology and farmers' agricultural activities in KwaDlangezwa. The rural and small-scale farmers' shift to commercial farming should be monitored and encouraged. Moreover, small-scale farmers working together as consortiums could reach economies of scale more quickly; farmers in KwaDlangezwa collaborating could assist in developing finance and marketing platforms since the output will be enormous. There is also

room for investment in sectors and technologies like hydroponics and urban farming, but farmers will require help with soil analysis, harvesting, and post-harvest technology, as well as financial support (Venter, 2019).

Small-scale farmers have used crop waste, for example, to feed animals, while animal waste could be used to make biogas and grow vegetables. Given that the majority of small-scale farmers' farms are in locations with poor soils, this would be a way to reduce waste while also improving the soils' suitability for farming in order to generate more crops (Namara et al., 2014). Also, the findings revealed that small-scale farmers might choose to vary the goods they grow and farm in order to avoid the overabundance of certain products while shortages exist in others, allowing all stakeholders in the value chain to gain. For instance, most farmers in KwaDlangezwa are selling similar products, such as fruit and vegetables. Small-scale farmers are currently competing with larger farming firms to sell their products, and they experience distressing expenses such as transportation; in the process of trying to sell their products, which are sometimes overlooked at markets and judged on quality and quantity. According to the findings, the supply chain must be reduced to make items more affordable to end-users and to allow for the delivery of fresher products. This can be accomplished by making goods available to the general public in KwaDlangezwa and nearby customers. Based on the findings, the KwaDlangezwa (customers) community own gardens and do have all kinds of fruit as a result; the small-scale product is bought by students and staff members at the University of Zululand.

According to the findings, small-scale farmers are having difficulties in adopting irrigation technologies for optimal output, which has ramifications for long-term water management systems due to cost recovery regulations. This is supported by Begashaw et al., (2019) who stress that the key socio-economic factors influencing inefficiency in vegetable production are asset ownership, non-farm income, small farm size, high consumer expenditure, illiteracy, and large family size. They continue that limited access to financial markets, excessive consumer expenditure, and big family size are all to blame for the low economic efficiency ratings found. Interventions involving digital technology result in good long-term environmental impacts. These interventions improve the efficiency with which resources and inputs

are used. They also cut down on negative environmental impacts, greenhouse gas emissions, and food waste (El Bilali & Allahyari, 2018). A paper presented by Samii (2008) at a conference hosted by the International Fund for Agricultural Development (IFAD) described how small-scale farmers' lack of access to relevant information and digital technology negatively contribute to a slow progression to becoming commercial farmers. The findings of the study also discovered that the small-scale farmers in KwaDlangezwa rely more on word of mouth, as there are no platforms where they get agricultural updates and information.

According to the findings of the study small-scale farmers' excitement and determination to feed communities has not been dampened by the lack of financial support; rather, it demonstrates that there is a gap between government agricultural financial plan implementation and actual financial activities. Despite these obstacles, some small-scale farmers have succeeded and continue to produce food for the market using their own resources. Emerging farmers, on the other hand, struggle to produce massively, when they are denied significant help in order to meet retail requirements and expand to commercial farmers. Farming systems necessitate proper management of cold rooms, pack houses, full traceability, product soil and water analyses, all of which are costly and inaccessible to certain commercial farmers, let alone new farmers with limited finances.

According to the findings of the study, small-scale farmers have poor educational backgrounds and high levels of illiteracy; this contributes to limited market access from big retailers. Unfortunately, socioeconomic issues are to be blamed for small-scale farmers' weak infrastructure and access to agrarian services, as well as a lack of supporting services. The high risk of transaction costs, and certain racial groups benefiting more from the 4IR has brought a strain in fully supporting small-scale farmers and other agricultural associations financially. One small-scale farmer made an example: *“ever since I started with my business, there is not even one person to claim that they had assisted me from the beginning of this journey up to date. I have used my own money to keep this business running. As a result, it not of high importance to purchase 4IR tools.”* Adoption falls by the wayside when it comes to sophisticated technologies that require funds, integration and coordination.

Glover, Sumberg & Andersson (2016) proposed a design specification for an alternative concept to adoption that should (a) be conceptually and theoretically sound, as well as (b) provide a practical, reliable empirical framework for analysing and evaluating technological change and its implications. Small-scale farmers face different challenges. The study revealed that not all participants need the 4IR technological tools for sustaining their product - only the ones that produce sugarcane and specialise in poultry. Small-scale farmers producing fruit and vegetables are not in so much need to adopt the 4IR technologies. That is why their responses differed because their agricultural needs vary. However, there is one thing that makes them comparable, namely, that they are financially in need and government/ stakeholders have a huge role to play in developing and sustaining agriculture in South Africa.

#### **6.4. Theme 3. Government financial support**

The findings of the study explored the effectiveness of the model used by the South African government to finance commercial, small-scale and emerging black farmers for agricultural development and empowerment. It is widely acknowledged that the South African government spends a vast amount of money attempting to help black community members become commercial farmers. Even though South African agricultural development has a history of discrimination based on gender and race (Hart & Aliber 2012; Kloppers & Pienaar 2014), which has skewed land ownership patterns and individual contributions to the economy through agriculture. There are different government financing alternatives as well as programmes like the Land Redistribution for Agricultural Development (LRAD) and the Proactive Land Acquisition Strategy (PLAS). Despite the existence of all of these, black farmers remain underdeveloped and are characterised by failed agricultural initiatives resulting from a general lack of financial and logistical support for South African farmers (Aliber & Maluleke 2010; Hart & Aliber 2012). The South African government did indeed implement effective land reform programmes to alter the status quo and ensure that agriculture contributes meaningfully to the economy without discrimination based on race or gender, but the same programmes are questionable.

According to the findings of the study, there is a number of cases where it appears that agricultural contests have ongoing issues, as land reforms (Cousins 2002:1). To date, the Department of Rural Development and Land Reform (2016:4) asserts that South African agriculture has failed to perform as expected in terms of economic growth, rural development, job creation, equity and transformation. According to the findings of the study, the necessity of developing black farmers is through land access and financial assistance as they are the top priorities as farmers in South Africa, and agricultural growth, as this will increase black farmers' capacity and potential to contribute to agricultural development and the economy.

As is attested to by Greenberg (2013:2), the government's involvement in providing and assisting black farmers with funding, research development, and extension services, have remained woefully inadequate. Furthermore, farmers in South Africa face a shortage of financial intermediation, enterprise development services, and social services. It is suggested that if given the proper help, black farmers will be more likely to prosper and contribute to the development of South Africa's agriculture and economy. According to Groenewald (2004), small-scale farmers should be agriculturists with expertise and knowledge in farming; be of similar origin and have some capital of their own.

A small-scale farmer in the study also mentioned that: *I started my business without any government financial support. The confusing part is that there are funds allocated to small-scale farmers yearly from the department of agriculture; pity those funds have never reached us as black and small-scale farmers in KwaDlangezwa. The poultry business is a broad and complex project where with less livestock; it is not possible to make a profit. Taking care of animals is not as easy as it may seem. Even though we as farmers in KwaDlangezwa would appreciate and love to be assisted financially, there are other challenges that are a hindrance to our success, such as marketing. Our breeds are not suitable to supply butchereries but only for ceremonies and farming. We need that opportunity to expand our business and be in partnership with big retailers like Shoprite, Spar, Checkers and other stores.*

According to the findings of the study, small-scale farmers are restricted to apply for loans because of their meagre turnover. Rather, they prefer to sell output and reserve some for another input (ploughing) for the plants that use seeds such as maize/corn. The requirements that are exclusively meant for black farming entrepreneurs do not seem to benefit them at all. Small-scale farmers previously lacked both agricultural knowledge and practice as well as land.

The success of small-scale farmers in any country is based on the infrastructure available, which, in the case of black farmers in this study is lacking, and contribute to the insufficiency of agricultural output. Despite the promises of post-apartheid land reforms, access to land ownership remains a barrier for rising black farmers (Vink, Rooyen & Karaan, 2012:16). South Africa is still trying to keep its promise to black beneficiaries of agricultural land. Moreover, the findings of the study revealed that small-scale farmers have been allocated a little piece of land, and they have been crammed in as multifamily beneficiaries to the point where their agricultural practices are practically impossible to produce as intended. As a result, without equitable access to land, and the use of that land, young South African black farmers will be unable to play a viable agricultural role. Only a well-funded agricultural sector in South Africa that is non-discriminatory in its approach would ensure that everyone has a significant role as a contributor to the agricultural economy. Furthermore, from the findings, the youngest farmer shared that the issue of government financial support has delayed their business plans as farmers in KwaDlangezwa for dealing with key issues such as;

- ✓ Their stock is limited, because of inadequate funding
- ✓ Non-existence of market, supply chain (only regular customers)
- ✓ Small turnover
- ✓ Product only bought on special occasions such as festive seasons and for ceremonies

From the above-mentioned findings, other challenges were also revealed such as the lack of finance; as a result, access to bank loans has a huge role to play in the development of small-scale farmers.

- ✓ **Loan funding**

According to the findings of the study, small-scale farmers in KwaDlangezwa are not supported financially. As a result, their businesses have not produced enormously, but only sufficiently to sustain the business. Farmers as emerging farmers in Africa face a widespread challenge with credit funding (Onumah & Meinjerink 2011; Black, Conradie, & Gerwel, 2014:2; International Finance Corporation (2013)), which limits their ability to contribute to the agricultural economy. However, it was clear from the start that the African National Congress did not give any small-scale farmers financial help for farming production on claimed land as part of their land reform plan (Greenberg 2013:13). Commercial banks in South Africa, such as the First National Bank (FNB), the Amalgamated Banks of South Africa (ABSA), NEDBANK, and the Standard Bank of South Africa have created agri-business units that offer long- and short-term loans to potential agricultural farmers (Department of Agriculture, Forestry, and Fisheries 2013:22–25). Yet, the findings of the study; revealed that small-scale farmers are ineligible to access bank loans because of their turnover and other related shortfalls. According to the findings of the study, the bank eligibility requirements are difficult for new black farmers to meet; they can only be met by previously advantaged white farmers who can utilise existing assets as collateral for the loan.

#### ✓ **Grant funding**

According to the findings of the study, small-scale farmers in KwaDlangezwa do not receive any grants from the department of agriculture. As Olubode-Awusola & Van Schalkwyk (2006); Hall (2007:65) point out, the majority of grant cash is non-recoverable, and recipients receive it for free. Such grants are intended to promote the role of black farmers as emerging commercial farmers in South Africa as well as to empower them for future agricultural business sustainability. Neither loan nor grant funding strategies for aiding black farmers appear to have helped the intended South African beneficiaries. Employed farmers, for example, are not eligible for grants, despite their strong desire to promote agriculture and the fact that they could augment the funds with their earnings to pursue agricultural initiatives. They would certainly aid the government in avoiding the selection of low-income or cash-strapped people for agricultural initiatives.

As a result, government support programmes can influence project developments that provide a competitive advantage by improving new enterprises' ability to access financial resources. Government financial support in the form of loans and equity can help new ventures not only accumulate assets (Honjo & Harada 2006) and gain access to critical resources (e.g., technology, licences, and equipment), but also invest in internal firm processes like employee training (a building block for human-capital-based competitive advantage) and market-acceptance activities like establishing a brand name and developing unique product designs (marketing-related intangible assets).

#### **6.5. Theme 4. The 4IR and increase of output**

According to the findings of the study, farmers lacked knowledge of the 4IR agricultural tools. Their understanding of the 4IR tools was that they are expensive and will exacerbate the unemployment rate. Without a clear picture of the 4IR agricultural tools, the small-scale farmers were going to struggle to answer this objection. As a result, this also proved that small-scale farmers in KwaDlangezwa are used to old ways of farming and comfortable with their non-electronic tools. For Schwab (2016) the 4IR megatrends, applications and advancements, are evidenced by the identification of the technical shifts below that are becoming mainstream and influencing the digital world. From a list of 4IR characteristics there are;

- ✓ *Implantable Technologies*
- ✓ *Vision as the New Interface*
- ✓ *Ubiquitous Computing*
- ✓ *Storage for All*
- ✓ *The Internet of and for Things(IoT)*
- ✓ *The Connected Home*
- ✓ *Smart Cities*
- ✓ *Big Data for Decisions*
- ✓ *Driverless Cars*
- ✓ *Neuroethologies*

According to the findings of the study, the different video clips that the small-scale farmers watched helped them to have a full understanding of the 4IR tools, even though they were still concerned about the advancement of technology and the affordability of purchasing. A participant added that *“At this age, there is no need to purchase these advance tools while I struggle to maintain two hectares. As we speak,*

*I am about to sell my land. I have been years working on it and there is profit accumulated from it".* This is supported by Baweja, Donovan, Haefele, Siddiqi, and Smiles (2016) who found that the 4IR characteristics are in relation to the realm of work and the future of employment, while reshaping society and somehow, replacing human existence from other sectors (Lorenz, Rubmann, Strack, Lueth, and Bolle, 2015).

Agricultural modernisation and the adoption of appropriate irrigation technologies are heavily reliant on farmers' capacity to obtain and use inexpensive agricultural financing choices. Farmers who have access to financing can buy modern inputs such as high-yielding seeds, fertilisers, and irrigation equipment to boost production (Chowdhury & Garcia, 1993). According to the findings of the study, some small-scale farmers owned side businesses such as tuckshops and salons. They added that this is another way to accumulate more money and maintain their agricultural activities and allow them to purchase working tools. The study also revealed that small-scale farmers; appreciated technological tools in the agriculture sector also shared a valid point on the question of digital payments. Supported by FAO, 2013 and Joiner & Okeleke, (2019), the adoption of digital technology can improve access to payments, credit, and collateral management since it allows for quick and secure payments for products, inputs, agricultural subsidies, and remittances.

A student from Owen Sithole Agricultural College shared a lot about how they conduct their practicals. Most institutions are still using old tools for planting and animal maintenance. *"Doing practicals encourages us as students to see ourselves one day implementing the skills and knowledge we have. Cows are trained using a halter (it's a string to put on the cow and train it to adhere to any instructions given at that particular instance), there is also crush pen, head gate used for training inspectors. As a farmer it is important to know what to do when taking care of cows; they go through the horning iron process cutting horns while they are still young so that all the nutrition will be beneficial to feed the body, not horns which also have blood. Animals are also injected when it is necessary. One day, I will have my own farm and continue with my studies."* Data analytics analyses data and presents the results to external

customers and partners, for internal or external reporting and efficiency in agricultural development (FAO, 2013).

## **6.6. Theme 5. Skills and knowledge on Agri-tech**

Understanding what farmers value is critical to building digital agricultural value chain solutions that have a high uptake and commercial success (Wisdom et al., 2018). This means that the community involvement strategy and the collaborative approach are two strategic ways to meet farmers' information demands and also enhance skills and knowledge on advanced tools (Awuor, Raburu, Onditi, & Rambim, 2016). Farmers must be included in the creation and development of these digital technology solutions, as part of the community engagement approach. Moreover, government support combined with increased participation of residents in the formulation and implementation of creative ideas is a winning combination for a better understanding of Agri-tech.

The study found that farmers still hold old ways of farming, except for a few young farmers. As previously mentioned, most of the small-scale farmers have a primary educational level, which contributes to farmers inadequate skills and knowledge on advanced farming. Moreover, from the findings, small-scale farmers lacked knowledge of such satellites. According to Awuor et al. (2016), stakeholders should work together to complement each other and guarantee that individual interests are addressed, such as involving small-scale farmers in development. This will enable new skills and knowledge to be explored. The interest of people varies, with some people preferring to be practical and work for hand in hand with the suppliers. For the 4IR characteristics, it is vital to firstly explore the skills and knowledge of small-scale farmers on technology in general. The more small-scale farmers get used to the 4IR technologies, the more they will fully understand and exploit the digital agricultural value chain and their business models could meet local market realities, which necessitates scalable and sustainable company strategies (Joiner & Okeleke, 2019).

Agriculture stakeholders should promote collaboration and information exchange, as well as the creation and adaption of content in local languages and contexts to guarantee that resource-poor farmers have equitable and timely access to agricultural

knowledge and skills, more especially the ones based in rural areas like KwaDlangezwa (FAO et al., 2018). The farmers' skills and knowledge of the digital agricultural value chain must achieve critical mass in order for real improvement to occur; otherwise, digital liquidity will be minimal and transitory (Jackson & Weinberg, 2016). Agriculture stakeholders must promote public-private partnerships in collaboration with cooperatives, farmer organisations, universities, and research institutions to enable inclusive, efficient, economical, and sustainable digital technology services (FAO et al., 2018). This study involved the above individuals to get more insight on the place of 4IR in small-scale farmers' development. Participants contributed massively and, a gap was identified between all these parties. According to GSMA (2018), academics and practitioners can use the findings and recommendations of this study to implement digital technology adoption in small-scale farmers. As a result, academics and practitioners can broaden this field of study by updating agricultural technological tools.

Moreover, from the findings of the study, it is clear that digital technology can help small-scale farmers gain knowledge by giving new ways of providing extension services. There is a need to learn more about the motivations of the 4IR and the consequences of various actors related to its 4IR characteristics (Constantinides, Henfridsson, & Parker, 2018). As a result, understanding the rising complexity produced by various stakeholder constituencies with various worldviews demands a multidisciplinary skill and knowledge approach to digital development (Jokonya, 2016). The findings of the study also revealed that in order to ensure that digital technology is used to benefit the poor, it should accommodate their skills and knowledge before introducing any agricultural innovations. Deichmann & Mishra (2019) suggest that the 4IR's main focus should be on enhancing and promoting skills development in small-scale and emerging farmers.

The use of digital technology for productivity and economic sustainability is restricted in its capacity to enhance the skills and knowledge of small-scale farmers. This implies that in order for digital technology to be used successfully in small-scale agriculture, the government and other agricultural development groups must support it. The poor are increasingly relying on digital advancement to boost their capacity (abilities) to perform additional tasks but they lack the appropriate skills

and knowledge. Agriculture is becoming increasingly knowledge-intensive, and getting such knowledge is getting increasingly difficult. The information must be adapted to local situations, which might be difficult. In the field of agriculture, by favourably influencing the ability to enter commercial markets, digital tools can boost access to commercial markets (NAHF, 2017).

Again, technology adopters (small-scale farmers) are limited to a selection of technological packages, artefacts, and systems. In the study, a participant from the Agricultural Research Council shared that *“there is information available for both commercials and small-scale farmers to enhance their skills and knowledge. Farming is diverse and the more farmers gain skills the more they are capable of benefiting from the technological tools at hand. Maybe, one may argue that there is sufficient and effective information about agriculture, but the farmers in remote areas fail to utilise it. As a result, the same information ends up benefiting people outside SA, wherein it was developed and mainly recommended for SA farmers”*.

## **6.7. Theme 6. The need for policy innovation in SA agriculture?**

There have been different platforms and programmes under government observation, encouraging agricultural innovation, assisting in the development of rural capacity, and providing pro-poor solutions for rural social development. Joiner and Okeleke (2019) assert that governments may help farmers by providing an enabling regulatory environment that encourages donors and investors to participate in viable services that take into account local market realities. Family farmers, rural women, indigenous communities, youth, and other vulnerable or marginalised individuals in rural areas require strong political intervention (FAO, 2015).

Many social ramifications have been overlooked. Policymakers in both the ICT and agricultural sectors must promote this new technology revolution (4IR) by utilising the context of digital development. Heeks (2016) defines digital development as socio-technical systems in which digital technology and society are intertwined and shape each other. These socio-technical systems are of an economic, political, and social nature, and they are implicated in the desirability of development. Indeed,

government and development agency programmes and other efforts have increased rather than relieved the obstacles that new farmers face. Migrating into the commercial agricultural sector has been tough for young farmers who are still living in poverty (Aliber & Hall, 2012).

The failure of successive government attempts to incorporate emerging farmers into the commercial agricultural system has heightened the need for scientifically sound knowledge and a complete grasp of the issues that emerging farmers face. According to the findings of the study, the existing challenges have been around for years, and they are treated as matters to be resolved one day, such as land. In order to properly construct policies, development plans, programmes, and models targeted at supporting and increasing the transition of emerging farmers into commercial agricultural farming, a deeper understanding of specific issues that impede their development is critical to be addressed by the government (Chikazunga & Paradza, 2012:3-4).

Following the democratic transition in 1994, the removal of state subsidies to marketing boards, as well as the deregulation of the agricultural sector, generated major issues for commercial farmers, particularly previously disadvantaged farmers. Interest rate and export subsidies had been totally terminated by 1997, and by late 1998, all marketing control boards had been privatised. One of the respondents in the study expressed the view that *“as a sugarcane grower, there is not much we produce and our government is not willing to address the challenges we face as small-scale farmers, but rather import more sugar from other countries”*.

Moreover, from the findings of the study, it is clear that the newest farmers struggle to gain access to formal agricultural markets. As a result, developing farmers are uninterested in conventional marketplaces. Lack of market engagement is a prevalent feature of emerging farmers around the world, and Bie'nabe & Vermuelen (2011:494) identify it as a limitation to their development. Because of a variety of obstacles, emerging farmers in South Africa's underdeveloped rural areas find it difficult to participate in commercial markets (Makura & Mokoena 2001:455; Wynne & Lyne, 2003:566). Also, the findings showed that farmers' attempt to commercialise

their product but they are hampered by a lack of infrastructure. Users of technology are sometimes presented as victims rather than passive adapters.

Although it is sometimes recognised that technologies could be redesigned and reconstructed using more democratic and accountable principles to achieve alternative outcomes, technology is often depicted as a fixed entity, endowed with intrinsic characteristics and immanent potential that strongly determine outcomes (Kloppenburger, 2008). It is everyone's responsibility to ensure that natural resources are carefully managed so that current and future generations can live comfortably. Those who use land and water should be given the incentives, resources, and information they need to make informed decisions. Removing many of the policy roadblocks that have hurt the soil and depleted water supplies, and encouraging successful farming under the premise that profiting from natural resources is vital for policy innovation. Participants also shared the view that new policies should focus more on the following:

- ✓ *Firstly, farmers (commercial and small-scale/emerging) should own an SA (GAP) certificate, and Certificate in Poultry for farmers to have the right platform for selling their produce at Boxer and Pick and Pay.*
- ✓ *Innovative land policies, mainly to resolve SA's agricultural challenges (land issues).*
- ✓ *Policies on the long term- and reliable contracts on marketing in SA also enable farmers and customers to work together.*
- ✓ *For the government to have proper contracts with feeding schemes working directly with small-scale farmers.*
- ✓ *Policies on certain banks to assist with loans.*

All the above mentioned suggested policies were from the findings of the study, from farmers and non-farmers. Even though there is still a lot to be done there is a hope that things could get better if the agricultural policies are formulated and implemented in SA to rightfully address the agricultural challenges. Also, the findings of the study showed that working together, small-scale farmers could eliminate the hardship which comes with owning a big farm. While still on that note, it is wise to prompt the initiation of cooperating businesses between small-scale farmers. The manager at the Felixton Mill shared that “Yes, the marketing is good and profitable; the problem is when two

*farmers are registered under one business. As a result, it is also good to allow farmers to work hand in hand with others".* Constantinides et al., (2018) support this standpoint when they say that the government must include appropriate mechanisms and incentives for value generation, as well as a balance of openness and control among various stakeholders. The value of knowledge in addressing the difficulties facing South Africa's small-scale agriculture sector cannot be overstated (SDSN, 2015).

The government can use innovation policy to improve agricultural production practices and intervene by encouraging inclusive transformation and capacity building and ensuring the availability of pro-poor social innovations (SDSN,2015). This research is part of a larger initiative to establish a systemic, inclusive, and socially responsible framework to guide the adoption of digital innovation in South Africa to support sustainable small-scale agriculture development under appropriate policies.

Small-scale farmers in South Africa will benefit from the 4IR if the government uses terms like policy development, policy acceptance, and policy value (Bayer, 2018). The main goal is to strengthen the policy environment so that more money can be invested in developing farmers in SA and rural development projects (FAO, 2013, 2018). Furthermore, by identifying a gap for action, the development of digital platforms and programmes should support excellent policy practices for digital adoption in agriculture (FAO et al., 2018). Agricultural policy in agrarian South African should improve domestic agriculture's competitiveness with the rest of the world, both domestically and worldwide, particularly in terms of quality (Begashaw, Verburg, Yamauchi, Fattibene, & Yasuo, 2019). The government should create an enabling environment for the digital services industry's expansion, as well as expand the number of rural telecentres (Matto, 2018).

According to the findings of the study, it is vital to reduce legal and regulatory barriers, and policies must ensure that effective procedures are in place. In line with the view of the FAO (2018), small-scale farmers should receive direct support from enterprises that provide digital technology services. The widespread adoption of appropriate technology for agriculture, the environment, and risk management can be aided by government policy. Agriculture policy concerns should boost productivity growth while

also improving the sustainable use of land, water, and biodiversity resources (FAO et al., 2018). They should raise awareness among smallholder farmers about the benefits of digital technology use, such as fast access to agricultural information.

Due to the highly unequal outcomes and significant wealth inequality within countries, there is currently a need to strive for more socially just distributive outcomes (Horner & Alford, 2010; Begashaw et al., 2019). Countries should work together to create a global food system that is interconnected, inclusive, and egalitarian, and advocate policies and practices that benefit small-scale farmers, rural households, and the environment. In the agro-processing industry, women and young people are under-represented.

## **CHAPTER SUMMARY**

The findings of the study show that it is important to improve communication, increase knowledge, market access, business ideas, and income, give farmers more of a voice, save time, and enhance job satisfaction. Moreover, there is a need to restructure the agency of the innovative agricultural framework, with the structure consisting of institutions and organisations, discourses, policies and programmes, laws and informal laws, as well as digital technology access.

The function of digital technology intervention in development is not always evident, and it is frequently hampered by crucial difficulties related to social change improvement. The systematic aspect of the development process is identified by using the Capabilities Approach (CA) as the theoretical underpinning. Examples from the research findings might be used to highlight structural aspects. The lack of proper regulations and programmes to assist awareness and training to stimulate the use of digital technology among small-scale farmers, for example, is a political aspect that creates a structural barrier. Furthermore, the high cost is due to insufficient legislation and informal laws that restrict the affordability of purchasing and accessing digital technology.

In terms of access to digital technology, this causes structural impediments. A structural barrier is a lack of knowledge of the potential of digital technology to improve the sustainability of small-scale farmers as a result of inadequate government policies

or programmes. Implementing policies and initiatives to develop rural digital technology hubs that provide extension services to small-scale farmers is one example of a structure that might help small-scale farmers adopt digital technology. Similarly, a small-scale farmer's level of digital technology adoption, and thus the impact it has on the farm, can be influenced by a variety of agency resources.

For example, the lack of infrastructure resources creates a hindrance for small-scale farmers to use digital technology. There are also various other limitations than resources that include insufficient financial resources and a low level of literacy that is coupled with a lack of training. Variations of development outcomes can have different outcomes among participants who share similar structure and agency resources. The findings showed that when developing small-scale farmers, the structure (political, social, and economic factors) that exists could influence the choices of small-scale farmers that can lead to certain development outcomes.

The development outcomes can improve small-scale farmers' agency, which can lead to greater structure use. The use of structure can also have an impact on a small-scale farmer's agency. Choices can be made as a result of how structure and agency interact, and these choices can lead to more development outcomes. To attain development goals, small-scale farmers must be able to choose between different options. Secondly, they need to know whether or not that option is available. Finally, they must make use of the choice to pick and arrive at a conclusion.

When small-scale farmers make the decision to utilise or not use digital technology, they meet the primary goal of "choice achievement." The nature and scope of development outcomes are influenced by these factors of choice. Secondary development outcomes such as improved communication and understanding can lead to other benefits such as improved market access, company ideas, and more income. As a result, increasing the capacities of resources under agency can help to attain development goals. Small-scale farmers can influence their resources within agencies and so raise their prospective functions if they can improve the attainment of functions such as quicker communication utilising digital technologies. Some development outcomes have the ability to impact structure, just as they have influenced agency resources.

## **CHAPTER SEVEN**

### **CONCLUSIONS, RECOMMENDATIONS AND LIMITATIONS**

#### **7.1. Introduction**

In the previous chapter, the findings of the study were presented and discussed. The study revealed that technology advancement has been used as a tool to develop and accumulate more output over a short period of time. From the 1<sup>st</sup> to the 4<sup>th</sup> industrial revolution, farmers have used agricultural technologies; even though there are some troubles while trying to adopt such development. The previous chapters explored and questioned the capability and adaptability of small-scale farmers to the 4IR. On that note, this chapter is mainly concerned with the conclusions, recommendations and limitations specifically from the findings of this study and using the results drawn from the previous chapter. This chapter will touch on the research objectives and research questions from chapter one.

For decades, agriculture has played a huge role in employment and contributing to the GDP. The creation of jobs has been achieved through farmers owning bigger farms with different produce. The 4IR is supposed to focus or re-direct if necessary, on the expansion of small-scale farmers' output. As a result, revisiting the previous technology used in farming will help to detect gaps and reproduce the most suitable tools for small-scale farmers. Therefore, the implications of the 4IR will improve the agricultural output without threatening small-scale farmers' existence. Even though the government has adopted and implemented some of the 4IR tools in agriculture, there are still challenges obstructing the full adoption of the 4IR by small-scale farmers. The role of government and stakeholders in the development of agriculture is vital.

#### **7.2 Objectives of the study**

The below objectives were used to answer the research questions:

1. To assess the perceptions of small-scale farmers concerning the implications of the Fourth Industrial Revolution, and its benefits to their output.

2. To determine the challenges faced by small-scale farmers while reflecting on the factors contributing to their experiences.
3. To explore the extent of the government and stakeholders' financial support for small-scale farming.
4. To evaluate whether the 4IR characteristics will increase the agricultural output and organisational tasks in KwaDlangezwa area.
5. To examine the level and extent of the Agri-tech knowledge and skills of farmers in KwaDlangezwa.
6. To suggest any innovative policy frameworks and recommendations for small-scale farmers' agricultural sustainability.

### **7.3. Key research questions**

Research questions are part of the fundamental means of answering the unknown and of obtaining new knowledge. This study responded to the following key questions:

- Is the Fourth Industrial Revolution, going to benefit small-scale farming in KwaDlangezwa KwaZulu Natal in South Africa.
- Are there any challenges encountered by small-scale farmers, and what are the contributing factors to their daily experience?
- What are the implications of the Fourth Industrial Revolution, and government policies on small-scale farmers' development to greater output?
- To what extent does small scale farmers benefit from the government's fiscal support and other agricultural sectors stakeholders? How knowledgeable and skilful are farmers about Agri-tech and 4IR characteristics in the KwaDlangezwa area.
- Is there a need for new agricultural policies, specifically for small-scale farmers regarding the emerging 4IR; in order to successfully develop agriculture in

KwaDlangezwa. It was very important for the study to validate the objectives which are listed below and discussed

**7.3.1. Objective 1.** To assess the perceptions of small-scale farmers concerning the implications of the Fourth Industrial Revolution, and its benefits to their output.

From the findings of the study, the 4IR is perceived to be an enabler; digital technology may appear attractive in the near term while delaying the resolution of the underlying issues. There is a need to learn more about the motivations and consequences of various actors. As a result, understanding the rising complexity generated by multiple stakeholder constituencies with distinct worldviews is required for digital progress. The focus should be on strengthening the business climate, promoting skills development, and holding the government accountable in order to ensure that digital technology is used to empower the poor. This emphasises the need for comprehending the various economic, political, and social aspects that influence digital adoption by small-scale farmers in KwaDlangezwa.

AI, Blockchain, the Internet of Things (IoT), Big Data, and Drones are just a handful of the emerging and evolving technologies included in the term 4IR. It also provides cutting-edge organisational, production, and distribution methods based on digital transformation and automation, which may blur the distinctions between physical products and transform them into complex systems of interconnected and interdependent elements. As a result, these technologies have the potential to boost agricultural productivity and profitability while also generating new local added value. From the findings of the study, the fourth industrial revolution (4IR) has the potential to change how all agricultural stakeholders, from small family farmers to huge commercial producers, generate food and related items. As the globe evolves at a quick rate, farmers all over the world are beginning to adopt new technologies to improve their farm operations and enhance profit. The results further show that the small-scale farmers in KwaDlangezwa do not use advanced technologies, but still rely on the old ways of farming. Even though the manager at Felixton Mill did mention that some of the sugarcane growers use drones it does not mean small-scale farmers have full access to such technology. As for commercial farmers, it is easy for them to utilise

drones because they own more than 4 hectares and their landscape allows such technology to operate. From the findings of the study, small-scale farmers had a different understanding of how they will benefit from the use of technology. For example, small-scale farmers active in sugarcane were more positive and willing to know more about the 4IR compared to fruit and vegetable farmers. Most of the 4IR technology seemed to be more beneficial to farmers owning more than 3 hectares, such as flying drones.

The results further show that the older small-scale farmers in KwaDlangezwa, were not very interested in the 4IR implications; they preferred to continue with their same old ways which seemingly are more comfortable for them. The study also showed that old farmers are not willing to participate in any development unless someone from the government proves that this change will not harm their farms. Even though the small-scale farmers knew that the 4IR comes with lots of benefits, such as helping with farm infrastructure inspection, prescription map development, high-resolution mapping and surveying of individual fields, and crop damage assessment they still questioned it. Most farmers were concerned about what is new compared to previous technologies, asking what has changed in order for them to adopt and fully depend on these technologies.

**7.4. Objective 2.** To assess the challenges faced by small-scale farmers while reflecting on contributing factors towards their experiences.

Small-scale farming is referred to as farming that takes place on relatively small pieces of land. Land size in small-scale agriculture is limited to four hectares. The majority of the work is done by family members and is manual. Farmers cultivate their land with simple equipment like hoes and machetes, and in certain circumstances, ploughs. Organic manure is used by farmers to boost fertility. On the farm, the farmer often produces a variety of crops, such as maize and vegetables, to provide food for the family. The findings of the study revealed that for the majority of farmers in KwaDlangezwa specifically producing vegetables and fruit most of their farm harvest is for family consumption. Furthermore, the findings showed that small-scale farmers were active in animals are kept by the majority of farmers. The manure utilised on the

farm comes from these animals and fowl, and some farmers used it in plant cultivation and for quality output such as sweet potato.

The study further revealed that small scale farmers fail to produce much output for sale, simply because they use most of the crops themselves. This is not like the sugarcane growers, who use the crops after harvest. As for poultry farmers, the capital has been a huge challenge, and they battle to get a loan from banks for start-ups. Even though the department of agriculture does supply the farmers with crops, they are seasonal. The findings of the study also showed that small-scale farmers are struggling to test soil, which costs R120 per test. The soil testing helps in keeping up with knowing what to use in order to produce a greater output.

The findings of the study showed that small-scale farmers in KwaDlangezwa lacked financial support for new enterprises. Most farmers depended on agriculture activities except for the few that had tuckshops, and trucks to deliver soil. This proves that, when there is profit, farmers can expand their businesses and employ more people. Farmers in the study felt that the challenges they are facing need the government to visit different places to explore them and come up with resolutions based on facts. This can aid government officials in detecting obstacles, establishing the source of underperformance, and identifying business expansion prospects. Small-scale farming is the backbone of agricultural output in South Africa. A number of structural and legal challenges have historically impeded the productivity of small-scale agricultural systems, resulting in low yield increase and even stagnation in some areas and for specific crops. In many developing countries, food insecurity is blamed on a range of factors, including a lack of technology, inadequate land, limited access to technology, lack of well-structured marketing and improper use of technology. The findings found that small-scale farmers at KwaDlangezwa experienced the common challenges.

The findings further reveal that small-scale farmers depend more on the old tools such as *Igeja* (garden hoes), spades, wheel hoes, broad forks, seeds, trenching shovels and *Ucelemba* (pang ) to cut trees. Not even one small-scale farmer can afford to

purchase a tractor. Sugarcane growers in KwaDlangezwa use a system of hiring tractors, and trucks to transport their product to Felixton Mill. However, small-scale farmers in sugarcane do have a proper and reliable marketing system. A participant in the study also touched on the challenges faced during and after the harvesting of sugarcane. Their machines are not protected, and people steal the sugarcane at *pandini* (storage place), which is not fenced.

The findings further show that harvest processes are carried out according to the availability of tractors and trucks. The majority of these issues stem from a lack of finance, education, and connections. Fruit and vegetable farmers who form co-operatives can decrease their expenses by pooling them and can also increase access to important, contextual knowledge and help poor farmers succeed. The findings also show that small-scale sugarcane farmers use few fertilisers than they should. This is partly due to a lack of knowledge about which fertilisers are best for their individual soils. But, more crucially, they lack the financial means to purchase and transport fertilisers to their farming areas, which are sometimes located far from large cities and are accessible only by impassable roads.

#### **7.4.1. Challenges faced by small-scale farmers in KwaDlangezwa**

The findings of the study further show that the small-scale farmers in KwaDlangezwa mostly produce similar crops, with maize, beans, millet, fruit, such as; banana, oranges, mango and vegetables being among the most common crops farmed. The amount of land accessible for farming is extremely limited. In many circumstances, yields per unit area are likewise low. Profits among small-scale farmers can be invested back into local economies. As a result, the creation of opportunities for rural youth in order to live and thrive in their home communities will be accomplished. Small-scale farming systems are often more environmentally sustainable and accommodative to farmers who are not financially stable. Small-scale farmers using nature-based practices such as crop rotation, and organic agriculture incorporating pest management permaculture depend on the wealth of localised environmental knowledge that small-scale farmers hold.

#### **7.4.2. The benefit of agricultural tools ( 4IR)**

Small-scale farms are especially important for vulnerable communities' food security and nutrition. These farms primarily service domestic and local markets, including communities that are not served by modern supermarkets. They are especially crucial in KwaDlangezwa. The findings show that through improved management practices and interventions, digital adoption has the ability to increase the food security, income, and asset value of rural households. Additionally, farmers' livelihoods can be improved, productivity increased, waste reduced, and digital and financial inclusion be promoted in rural communities (KwaDlangezwa).

**7.5. Objective 3.** How effective is government and stakeholders' agricultural financial support to small-scale farmers, and if not effective what are the contributing factors?

The findings also reveal that the SOPA 2020 (State of the Province Address) and programmes of action 2020, were mainly for rural development and youth employment. Even though there are programmes for rural development, from the findings the KwaDlangezwa small-scale farmers lack information and connection to such schemes. One of the factors contributing to this is that most strategies are formulated and developed without farmer or community concerns being taken into consideration. It is vital to communicate and reach out to people, in this case small-scale farmers, for the plan to reach its purpose. As a result, the department of agriculture has programmes for the development of farmers in different regions, but the same targeted groups lack platforms to communicate and obtain such information. One of the issues faced by small-scale farmers is that even the community engagements have failed to address financial challenges.

The findings of the study also revealed that small-scale farmers are well aware of the challenges that should be prioritised by the government such as education, health, corruption, rural development and land reform, and job creation. Furthermore, agricultural development requires government intervention in the form of facilitation, support and funding of activities. The findings further show that both municipalities (

Mpangeni and Richards Bay) have been developing strategies to overcome agricultural obstacles. Government officials do not conduct a survey before formulating and implementing development plans; as a result, most development plans done locally fail to resolve agricultural challenges.

During the interviews that were conducted, it was emphasised that although the government has strategies they are not rightly implemented and there is no strategy for guiding the implementation process. The development of a 4IR strategy requires the full participation of community members and other stakeholders so that it is relevant to people's needs. Engagement with key stakeholders, including the community, is the key to the development of initiatives that will empower people and bring social and economic development. The findings also reveal that it is crucial to understand and unpack the economic trends in the area, as this assists in terms of aligning the strategy with local resources and ensuring that people are able to use local resources effectively. Moreover, the findings show that the rules for governance are meant to ensure that digital technology is used to help small-scale farmers in rural areas, to examine the broader institutional support that is required for the success of digital technology interventions, and to investigate governance norms that will allow players on digital platforms to earn value for one another. The findings further show that a comprehensive development framework is essential to aid in the adoption of digital technology by small-scale farmers' agricultural value chains (AVCs). It is necessary to investigate the ramifications and find both positive and negative outcomes for society as a whole. To avoid the global economy favouring the wealthy over the poor, digital information, as one of the new economy's fuels, must be better secured and managed.

The 4IR framework proposes a comprehensive strategy for strengthening small-scale farmers' capacity to adopt new technology and best practices for farm-level transformation. Furthermore, the findings revealed that governments should provide public goods related to smart agricultural technology that benefit the majority of participants, particularly small-scale farmers. Agricultural Productivity and Sustainability has developed an integrated framework for digital adoption based on stakeholders' interests to accelerate the innovation process in the agricultural sector

by bringing research and practice closer together in innovation projects to facilitate access to markets by fostering connections between competence centres, the farming sector, IT suppliers, digital technology experts, and investors.

**7.6. Objective 4.** To evaluate whether the 4IR characteristics will increase the agricultural output and organisational tasks in KwaDlangezwa area.

The findings show that farmers from the 3 different categories sugarcane growers, fruit and vegetables and poultry are still relying on the usage of old tools. They are not funded to purchase the advanced technological tools brought by the 4IR. For instance, sugarcane and vegetable/fruit farmers prefer to continue using old machines and hiring people for farm activities. Moreover, farmers made it clear that the same old tools are handy and they can borrow from each other when necessary. On the other hand, the importance of technology was not denied by these farmers, as they further mentioned that they are short of cold and store rooms.

The study also found that *Mcebisi* farm uses incubators to keep its chicks. With such a strong statement, it is clear that farmers wish to adopt these technologies but the issue is affordability and capability. A younger farmer commented that with the use of 4IR technologies farmers will benefit more and succeed marvellously. They further explained that the 4IR technology will be of great benefit and allow small-scale farmers to control their land /farms and weeds, thereby contributing to better yields.

The findings of the study continued to reveal various impediments to digital adoption in small-scale agriculture that are beyond the farmers' control. Because most small-scale farmers have modest earnings, purchasing digital equipment on their own is challenging, if not impossible. As a result, the use of digital technology for productivity and economic sustainability is restricted. This implies that, in order for digital technology to be used successfully in small-scale agriculture, the government and other agricultural development groups should fully support it. More detailed reasoning behind, small-scale farmers failing to adjust and adopt into 4IR was presented in Chapter 6 and this specifies that farmers in KwaDlangezwa felt they have been side-

lined for years. As a result, they are not willing to seek help from anyone. Ever since they started their businesses have struggled, hoping that younger farmers would not go through the same agricultural challenges. There is a gap between the department of agriculture and small-scale farmers. Even though, the department tries to attend to some of the challenges it is not possible to rectify all of them at once. Also, the number of farmers with no funding and technological need is growing because of the high rate of unemployment.

#### **7.7. Objective 5.** How knowledgeable and skilful are farmers in Agri-tech and 4IR characteristics in KwaDlangezwa area.

The findings of the study show that small-scale farmers' low capacity for use of digital technology, as well as a lack of digital technology infrastructure in rural areas, are key issues. A major stumbling block is a lack of digital technology capabilities among researchers and a lack of power infrastructure for spreading agricultural information to farmers. Moreover, the study revealed that small-scale farmers experienced poor education levels, little money, cultural inertia, and a scarcity of appropriate localised information in local languages as barriers to small-scale farmers adopting digital technologies (4IR). Language, poverty, and illiteracy have been recognised as important impediments to small-scale farmers in South Africa, KZN and KwaDlangezwa.

In the discussion provided in the previous chapters it was noted that, due to a lack of infrastructure, poor literacy levels, a lack of appropriate information services, and a lack of technical competencies, there is insufficient information for small-scale farmers. Small-scale farmers' lack of access to important information and digital technology infrastructure then causes a lack of access to key stakeholders in the agriculture value chain, such as processors, merchants, and consumers. From the findings drawn from the study, farmers' attitudes about the adoption of new technology alter over time as technology advances. They validated their countless reasons, such as high costs, time constraints, and comfort with current practices, for not adopting profitable farming technologies in KwaDlangezwa. Moreover, the findings of the study show that young, educated and experienced small-scale farmers are more willing to adopt technologies

for financial gain, and are also more concerned with environmental benefits and advanced agricultural practices. However, the study also showed that small-scale farming is frequently more productive than other agricultural operations, such as industrial farms. Because of the advantages associated with family-based labour and management, land production on small farms has been found to be higher in many circumstances. Family farms create more job opportunities while sharing basic agricultural skills and knowledge.

**7.8. Objective 6.** Are there any suggestions for new policies and recommendations regarding 4IR, small-scale farmers and agricultural stability?

The findings of the study also proposed that government policies must assist farmers in their operational functions and establish an enabling regulatory environment, while donors and investors must invest in viable services and take into account local market realities. Data governance conditions, as well as the availability and quality of IT infrastructure, influence small-scale farmers' adoption of digital technologies. Moreover, agricultural research councils need to be aware of what and which techniques can be used to connect actors, mainly to develop small-scale farmers. Also, the findings show that practitioners and scholars must be aware of the influence that some corporations have over small-scale farmers and trading partners' behaviours and capacities.

Furthermore, the findings of the study suggested that agricultural policies should allow local absorption of external digital solutions and that these policies must also play a critical role in assisting local capacity building and bridging knowledge gaps between innovation producers and rural communities. The government should stimulate private investment in cheap, low-cost technology and services by assisting public and private sector institutions. It should also make information and data sharing easier, with necessary safeguards and intellectual property rights protection, by conducting tests and launching pilot programmes before scaling up. This will be done through farmer-centred participation and collaboration when developing policy. The findings of the study are part of a broader project to construct a comprehensive framework that is

systemic. To guide the adoption of digital innovation(4IR) to support sustainable small-scale agriculture development in South Africa (KwaDlangezwa), it must be inclusive and socially responsible. The study also looked into the governance and institutional aspects that need to be taken into account when developing policy to support digital adoption in the small-scale farmers' agriculture value chain.

Furthermore, the findings show that digital development, technology adoption, agriculture value chains, small-scale farmers, institutions, governance, social factors, political factors, achieve this goal. When it comes to digital technology, a country's rules and regulatory framework must be taken into account. When designing solutions for digital technology adoption (4IR) by small-scale farmers, the findings emphasise the necessity of the state's involvement, farmers' participation, and the need for collaboration. The main goal is to strengthen the policy environment so that more money may be invested in climate-smart agriculture businesses and projects. Furthermore, by identifying a gap for action, the development of digital platforms and programmes should support excellent policy practices for digital adoption in agriculture. Policy in agriculture should improve domestic agriculture's competitiveness with the rest of the world, both domestically and worldwide, especially in terms of quality. The government should create an atmosphere that encourages the expansion of the digital services industry and expand the number of rural telecentres. By reducing legal and regulatory barriers, policies must ensure that effective procedures are in place. Small-scale farmers should receive direct support from enterprises that provide digital technology services.

Lastly, the findings proposed that agriculture policy should address issues including digital technologies while boosting productivity development and also ensuring the sustainable use of land, water, market and biodiversity resources. They should educate smallholder farmers about the benefits of adopting digital technology, such as fast access to agricultural information from reliable sources. Agricultural policies in SA should encourage practices that provide possibilities for small-scale farmers, rural families, women, and young people in the agro-processing industry to establish an integrated, inclusive, and equitable global food system. The digital agricultural value chain innovations can make agriculture more appealing to young people, who are well-positioned to profit from the potential. As the world becomes more complex, they are

more open to new technology, and the findings have proved that they are keener on trying the 4IR technologies. The importance of smallholder farmers has been highlighted in South Africa as the government navigates the difficult process of land reform, according to this report. Emerging black farmers are expected to increase their part in the country's agricultural economic activity by focusing on small-scale producers.

## **7.9. CONTRIBUTION TO THE BODY OF KNOWLEDGE**

From this study, it was revealed that the 4IR technological tools are the continuity of the previous revolutions. This study revealed that small-scale farmers have been surviving on their finances to keep the business running. As a result, it was hard for them to share their experiences on technology without owning any of the agricultural tools, except for using the old machines. The study also made an academic contribution to the relevant body of knowledge based on the findings. The findings of the study showed that 4IR agricultural technology tools are more advanced but, not desired specifically by developing small-scale farmers. Some of the existing issues/challenges are that the implementation of the 4IR in the advancement of agricultural output has been approached with more determination by commercial farmers, who are already fully equipped with such knowledge and skills. The 4IR and other agricultural tools have been used in developed countries, but the reality is that developing countries fail to deliver exceptional output. The use of technology has brought transformation and great change to different institutions, hence one may not deny that whether ready or not South Africa should make the means to adopt such technologies for agricultural sustainability.

Apart from the 4IR implications, government (through policies), the department of agriculture, the research council, and institutions specialising in agriculture such as the University of Zululand and Owen Sithole College, and other institutions specialising in science (for example, the University of Johannesburg) should work together to develop what is suitable for South Africa. The collaboration will assist much other business, simply because the short and long term plan will be targeting factual matters, and will resolve crises faced by businesses mainly in South Africa. The impact of digital

development can be measured using one of three lenses: economic, livelihood, or capability. The importance of understanding the socio-technical systems involved in the design, use, and governance of digital development of an economic, political, and social nature is also argued. To improve small-scale farmers' ability to use digital technology as a development tool in their processes and strategies, it is necessary to identify the social, political, and economic elements that influence their capabilities. The degree to which a person can convert a resource into a function is measured by conversion factors.

Using baseline research, surveys, and needs assessments, it is important to determine the best practices as well as agricultural knowledge and information needs. Market research concentrating on standards, requirements, and certification to determine the information flow pathway through small-scale farmers is essential as is determining the most efficient means of providing timely agricultural information and knowledge to small-scale farmers. In terms of certification, vegetable /fruit and poultry farmers in KwaDlangezwa lacked the knowledge of the fact that they can expand their businesses simply by having a certificate for marketing platforms.

For small-scale farmers producing vegetables and fruit, there is the SA Gap certificate in order to distribute their product in big retails. There is also the Dairy Primary Authority certificate, which is provided for the distribution of meat products and different breeds. This will improve small-scale farmers' skills and knowledge on using the 4IR tools also being trained while having a capacity building for small-scale farmers from their regions, as well as to determine the minimal literacy level required for them to use existing digital technology. Lastly, government and the department of agriculture should recognise the loopholes in current digital technology regulations that would hinder small-scale farmers from benefiting in 4IR, while working on filling up the gap and small-scale farmers' voices being heard in policymaking processes.

## **7.10. RECOMMENDATIONS**

South African smallholder farmers use less fertiliser than they should, particularly the sugarcane growers. The findings imply that grouping farmers together can help

address these difficulties, modernise farming, and increase small-scale farmers' income. As for the government, NGOs, and other rural development agencies prefer to engage with groups rather than individual farming households. Many farmer groups have arisen in South Africa. This makes it easier to reach and support a larger number of people at the same time. The study also discovered that the sharing of information and costs, as well as the bulk-buying power associated with such groupings, can lead to an increase in the usage of current technology such as inorganic fertilisers. As a result, crop yields and incomes improve, and group members also have better chances of earning than those who do not belong to a group. Moreover, small-scale farmers can work with the students from the Owen Sithole Agricultural College and the University of Zululand through community engagement and practical for students for animal check-ups and soil testing.

Even though there is a possibility that wealthier farmers, for example, could reap more benefits, owing to their social status and influence in the organisations, surprisingly, the farmers with no formal education will benefit from groups more than those with formal education. However, the advantages of group participation will not benefit all members equally. Adopting modern farming practices, such as the use of chemical fertilizers and hybrid seeds, can improve output. Farmers should also be encouraged to plan the operations of the groups, addressing such questions as: do they want to work together on the farm? Is the focus solely on purchasing inputs like fertilisers or marketing output as a group, rather than farming individually? Such groups can be established in a variety of ways to provide the most value to smallholder farmers. In order for this new approach to be successful, the government must reprioritise resources to enhance access to production equipment, research, markets, technical breakthroughs, and farm infrastructure. The infrastructure should be aligned with the SA Gap and also encourage small-scale farmers to have certificates for the possibility of opening more marketing doors for import and export.

The Department of Agriculture in 2020 announced that there was R28 billion allocated to agricultural development. The control and monitoring of to whom and how funds are distributed to small-scale farmers have been questioned. Furthermore, private investors who may provide technical expertise must be able to supplement public resources. For risk management and compliance with food safety requirements, food

traceability systems and digital technology tools have become critical. They track food as it moves through a supply chain, allowing downstream consumers to determine where it came from. It is crucial to understand how the state functions; it doesn't operate in a vacuum. The government should be committed to investing in smart agriculture and creating public goods related to smart agricultural technologies that benefit all stakeholders, particularly small-scale farmers. The government can use innovation policy to improve agricultural production practices and intervene by encouraging inclusive transformation and capacity building and ensuring the availability of pro-poor social innovations.

## **7.11. RECOMMENDATIONS FOR FUTURE RESEARCH**

Small-scale farmers in Africa should adopt innovative production tactics to enhance revenue and make farming more appealing to the next generation. Precision agriculture as a food production model in food processing, distribution, and consumption could be included. Agriculture is still seen as a means of achieving economic growth and development, particularly in underdeveloped countries. This viewpoint is reflected in South Africa's rural development framework, which states that this sector will be the primary driver in the development of the country's rural economies. But it should be noted that the agricultural industry of South Africa is known to be dualistic, with a large-scale commercial and a small-scale subsistence sector.

However, in light of the reality and continuance of poverty, as well as the raging land issue, an investigation into policy the Natives Land Act of 1913's legacy in post-apartheid South Africa small-scale farmers still face land crises. The socio-economic realities of today's South Africa are seen as being inherited through land dispossessions, (Maylam 1986:8, Everingham & Jannecke 2006:547, Helliker 2011:43-44; Hall 2010:18; Mngxitama 2006:41; Bradstock 2005:1979; Hendricks 2004:8; Carter & May 2001:1987). Small-scale agriculture, which involves family farmers, rural women, indigenous communities, youth, and other vulnerable or marginalised individuals in rural areas, requires a strong political will. Because many social ramifications have been overlooked, policymakers in both the ICT and agricultural sectors must promote this new technology revolution utilising the context

of digital development. Economic, political, and social systems that are involved in the design, use, and control of digital development are known as socio-technical systems. Small-scale farmers' adoption of digital technology should be discussed in relation to the role of digital technology adoption globally, as well as the role of digital technology adoption at the farmer level. Small-scale agricultural systems that are flourishing can provide solutions to many of the world's current difficulties while also improving the quality of life and livelihoods in rural areas.

However, there should be significant changes to the way food systems operate in order for this to happen. Small-scale farmers, for example, require markets that work for them, and research and innovation systems cannot continue to ignore their requirements. Furthermore, rural and urban regions must be better connected so that small-scale farmers can deliver healthy, affordable food to urban areas that are expanding. Before adopting the 4IR and other modern agricultural tools, these and other concerns connected to the obstacles faced by small-scale farmers and their communities must be at the forefront of the discussions and outcomes of agricultural development and the boosting of small-scale farmer production. Changing food systems to make them function for everyone begins with addressing the needs of people who work inside them. Only then will small-scale farmers be able to help countries overcome their agricultural crises. Poverty, unemployment, and diseases are among the challenges they face, even as they strive to provide a respectable living for themselves and their families.

## **7.12. CONCLUDING STATEMENT**

In order to succeed in 4IR, public policies directing technological innovation must be carefully crafted to maximise advantages while minimising costs. Countries, especially SA, require a comprehensive, effective, and implementable strategy to address issues such as digital and physical infrastructure gaps, the need for less onerous, nimbler regulation to speed technology transfer, and basic cognitive and socio-emotional skills discrepancies. This set of technologies is especially important for economic transition. One distinguishing feature is that the technologies do not cover issues (land, labour, financial, or physical capital) fundamentally, despite the fact that advanced robotics

and artificial intelligence (AI) have been built and employed in high-income countries to save low-skilled labour. Are these technologies capable of igniting or accelerating economic growth and job creation in South Africa? If so, where, how, and why should they be adopted?

It is essential to employ the conceptual frameworks of development as economic transformation and ethical development outcomes as the growth of people's talents and opportunities for decent labour in order to answer these concerns. It is commonly acknowledged that success in economic transformation is necessary for the expansion of higher income-generating options. Economic transformation is a term that encompasses two intertwined development processes. There has been much progress with regards to identifying the opportunities of digital use in agriculture. The use of digital technology integrated with aspects of agriculture development improves efficiency within the Agricultural Value Chain (AVC) and food production. Nonetheless, are they created to truly accommodate small-scale farmers, and if so, how? Many promising examples of positive digital impacts on small-scale agriculture development have often not scaled up. The below information, is meant for more clarity and reality in the commonly used agricultural tools used by farmers at KwaDlangezwa

### **7.13. PICTURES OF SMALL-SCALE FARMERS' TOOLS AND PRODUCE**

*These were captured by the researcher as a demonstration of the tools used by small-scale farmers in KwaDlangezwa and their product, and also to attest to the reality of agricultural tools at hand and ask whether they are ready or not for the 4IRagricultural tools.*

#### **Tools used by small-scale farmers in KwaDlangezwa**



Small-scale farmers pointed out that these tools are more affordable and can be used over many years. 4IR tools are perceived to be expensive and complex for them as farmers.

**Product (agricultural output) produced by Small-scale farmers in KwaDlangezwa (Vegetables)**





**Small-scale farmer Sugarcane grower in KwaDlangezwa**



### Poultry farming, and food in KwaDlangezwa



### Fruit sold in KwaDlangezwa by small-scale farmers





Some of the small-scale farmers used crops from packets that are sold at big retailers.



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Even though, small-scale farmers in KwaDlangezwa have achieved a lot and expanded their output there is still more to be done before they can be considered as being developed, small-scale farmers. Judging from the tools they are still using it is clear that the government and stakeholders have to work harder and introduce, formulate and implement development plans/policies which are well suited to resolving the challenges faced by small-scale farmers in KwaDlangezwa. From the findings, the department of agriculture, Felixton Mill, and the Agricultural Research Council can play a huge role, in developing and assisting small-scale farmers in producing much greater quantities. However, as they are government organisations they also face daily challenges, such as having limited working tools which are not even close to the 4IR tools. As a result, their interventions and assistance are not serving the full purpose of developing digital agricultural tools in South Africa.

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## APPENDICES

### UNIVERSITY OF ZULULAND

Faculty of Commerce, Administration and Law- Public Administration

Dear Respondent,

D. Admin Public Administration: Research Project

**Researcher:** Miss T.L Mtshali (0810964691)

**Supervisor:** Prof N.N Jili (035 902 6615)

I, **Thabisile Luyanda Mtshali** a D Admin student from the Faculty of Commerce, Administration and Law- Public Administration at the University of Zululand, would like to invite you to participate in a research project entitled “ The Place of the Fourth Industrial Revolution in Small-scale farming in KwaDlangezwa, Kwazulu- Natal, South Africa” . The aim of this study is to: **Explore the 4IR implications for the development of small-scale farmers in KwaDlangezwa in KwaZulu Natal, SA.**

Your participation is significant as it will reveal the 4IR agricultural tools at hand and show its importance in developing small-scale farmers in KwaDlangezwa. Agricultural development can be achieved through adopting innovative technology (4IR). The findings of the study, will assist small-scale farmers to increase agricultural output and for small-scale farmers to be commercial farmers in the near future.

As a participant, please note that your participation in this project is voluntary. This gives you the right to withdraw from the project at any time with no negative consequence. Also, there will be no financial gain from participating in this survey. The participants' details are

confidential and during the interviews there is no identification of the participant as they remain anonymous.

For any follow- up questions based on the completion of the interview or about participating in this study, please contact me or my supervisor on the numbers listed above. The interview should take about 30-45 minutes to complete.

Sincerely

Researcher's signature \_\_\_\_\_ Date \_\_\_\_\_

### **PARTICIPANT INFORMED CONSENT**

I .....(full names of participant) hereby confirm that I understand the contents of this document and the nature of the research project, and I consent to participating in the research project.

**I understand that I am at liberty to withdraw from the project at any time, should I so desire.**

**I hereby consent / do not consent to have this interview recorded**

SIGNATURE OF PARTICIPANT

DATE

**TOPIC: THE PLACE OF THE FOURTH INDUSTRIAL REVOLUTION IN SMALLSCALE FARMING IN KWADLANGEZWA, KWAZULU- NATAL, SOUTH AFRICA**

Student Name: T.L Mtshali (201143582)

Supervisor: Prof N.N Jili

**Interview questions to general individuals (Commercial and small-scale farmers, Traditional leader, customers)**

1. Is the Fourth Industrial Revolution, going to benefit small-scale farming in KwaDlangezwa KwaZulu Natal in South Africa?

1b) Has the previous technologies been effective for small-scale farmers? If not, what is different about the 4IR technologies and what can be done to make sure that small-scale farmers access Agri-tech?

2. Are there any challenges encountered by small-scale farmers, and what are the contributing factors to their daily experiences?

2a) Do you think the existing challenges in agriculture can be eliminated by 4IR technologies?

3. What are the implications of the Fourth Industrial Revolution, and government policies on small-scale farmer's development to greater output?

3a) Is there adequate information about the implications of the 4IR and policies for small-scale farmers?

4. To what extent does small scale farmers benefit from government's fiscal support and other agricultural sectors stakeholders?

4a) How effective and efficient is the financial assistance from government to small-scale farmers?

5. How knowledgeable and skilful are farmers about Agri-tech and 4IR characteristics in the KwaDlangezwa area.

5a) Is the 4IR going to be an extension of the old machines and traditional practices that were used by small-scale farmers or this is a new concept?

6. Is there a need for new agricultural policies, specifically for small-scale farmers regarding the emerging 4IR, in order to successfully develop agriculture in KwaDlangezwa?

6a) How important are the issues of Land, Market and Financial assistance in developing small-scale farmers?

6b) If the government gives a platform to outline new policies on small-scale farmers in KwaDlangezwa, your preferences will focus on what, and why?

**Government officials; Department of Agriculture, Research Council (researcher), Felixton Manager, Owen Sithole (Vice Principal) and Lecturers**

1. To what extent do you understand the 4IR technologies and what are the pros and cons of small-scale farmers engaging in advanced technologies?

2. How has the department of agriculture ensured that the information reaches and benefits small-scale farmers?

3. How effective is the information regarding the 4IR? Also, is the information couched in such a way as to accommodate illiterate farmers? If not, why not?

4. Apart from financial loans from the department of agriculture, do you think our banks in South Africa can assist with agricultural activities; what would be the pros and cons of helping small-scale farmers?

5. From a management point of view, do you think the 4IR characteristics will improve the agricultural output and alleviate the burden of organisational tasks?

6. How does the Department ensure that the information reaches and benefits small-scale farmers?
7. If you were a specialist in technology, how were you going to ensure that you accommodate commercial and small-scale farmers with regard to the newly purchased agricultural technologies?
8. Do you think the founders (experts) of the 4IR are reliable enough to train small-scale farmers on how to use the new equipment?
9. Have the academics and research scholars produced adequate information about the implications of the 4IR and policies for small-scale farmers?



agriculture  
& rural development  
Department:  
agriculture  
& rural development  
PROVINCE OF KWAZULU-NATAL



**OWEN SITHOLE COLLEGE OF AGRICULTURE**  
PRIVATE BAG X 20013, EMPANGENI, 3880 • TEL 035 795 1345 • FAX 035 795 1379

Dear Miss Mtshali

This letter confirms that the college grants you the permission to conduct interview as requested by you towards your studies registered with the University of Zululand.

For further enquiries, you are welcome to contact my office Email: katlego.shakwane@kzndard.gov.za or kshakwane@yahoo.com. Cell: 0726968011.

Regards,



Mr. Shakwane MK

Vice Principal-HET: OWEN SITHOLE COLLEGE OF AGRICULTURE

Tongaat Hulett Sugar  
Small Scale Growers (CRDU)  
Mills Walk  
Felixton  
3875

25 August 2021

**Research Conducted on Small Scale Growers**

This letter serves to confirm that Miss L Mtshali was granted permission to conduct an interview with the  
Tongaat Hulett Small Scale Growers team at Felixton on this day\_\_\_\_\_ of \_\_\_\_\_ 2021.

\_\_\_\_\_  
Small Scale Growers Felixton Manager

\_\_\_\_\_  
Date

\_\_\_\_\_  
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Tongaat Hulett Sugar South Africa Limited (Registration Number 1985/000565/06)

Date: 02/01/22

**To Whom It May Concern**

I am writing to confirm that the Doctoral thesis entitled:

**The Place of the Fourth Industrial Revolution in Small-scale farming in  
KwaDlangezwa, KwaZulu-Natal, South Africa**

By: L. Mtshali

has been edited for English language grammar and spelling.

**N.B.** This letter is issued on the understanding that all corrections and amendments recommended have been addressed by the candidate to the satisfaction of the supervisor.

A handwritten signature in black ink, appearing to read 'LB.' with a stylized flourish.

John Boughey (D. Phil., D.Ed., M.A. App. Ling., P.G.D.E., P.G.C.E. TEFL/TESL, M.A. (Hons) Eng. Lang. & Lit.)

