

Artificial Intelligence (AI) and Poverty Reduction in the Fourth Industrial Revolution (4IR)

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Abstract

The study aimed to investigate the influence of AI on poverty reduction using content analysis. The study went on to discover that AI has a strong influence on poverty in areas of relevant data collection through poverty maps, its ability to revolutionize agriculture, education, and the financial sector through digital financial inclusion. Researchers are using satellite images to map poverty, to identify the regions where poverty is more concentrated. This is helping a lot in the identification of the number of poor people and the regions where these people are located. Researchers are also using various robotics and AI programs “*such as Google and Stanford University’s Sustainability and Artificial Intelligence Lab*”, to come up with AI programs in agriculture which are helping to improve farming, through effective diseases detection, prediction of crop yields, and location of areas prone to a scarcity among several other notable signs of progress in education. Therefore, the study recommends that governments, development institutions and other organizations that are striving to fight poverty to invest more in AI as well as adopting and scaling up its use as it presents benefits in the quest to ensure that poverty is reduced.

Keywords: Artificial intelligence, Fourth Industrial Revolution, Poverty

JEL Classification: O1, O11, O3, O31

1. Introduction

The industry 4.0 or the fourth industrial revolution (4IR) is gaining a lot of attention particularly on its potential impact on humanity (Schwab 2015). Schwab (2015) argued that 4IR will change how human beings live, work and how the economies work as well as how we are governed. The industrial revolutions began as far as the 17th century with Britain being the major payer with what came to be known as the first industrial revolution (Blinov, 2014; Dunga, 2019). The word “*industrial revolution can be described as economic upheaval*” which necessitated the changes in the “*livelihood of the people from agrarian rural livelihood to city and town livelihood*” (Dunga, 2019). According to Blinov (2014) before the coming in of the first industrial revolution championed by Britain, economic activities were limited and as a result, many people were poor. During this period, human livelihood was sustained by what people get from the small farms which made live for an average person to be difficult (Allen, 2006).

Also, during this period production was mainly for own consumption, as a result, people were using basic tools which were mainly hand tools for production and production was mainly confined in people’s homes (Allen, 2006, Dunga, 2019). The coming in of the first industrial revolution marked the replacement of animal power to the steam engine which marked the “*shift from agrarian livelihood*” to industrialization where “*special-purpose machinery*” was

now used (Crafts, 1996). This marked the coming in of the first industrial revolution which started in Britain followed by other countries such as America and many others (Crafts, 1996). The development of the steam engine marked the beginning of the first industrial revolution around the start of the 18th century which allowed production to be “*mechanized for the first time, deriving social change as people became increasingly urbanized*” (Schwab, 2017). The first industrial revolution led to the rise in coal, textiles, iron, and rail road’s industries while the *second industrial revolution* came forth with the massive expansion of electricity, petroleum, and steel industries. Also, other and other scientific achievements led to mass production (Ooi et al., 2018).

Around the 1950s the *third industrial revolution* began with the inventions of computers and digital technology. The inventions of the second industrial revolution led the manufacturing sector to be automated. However, the inventions of the *third industrial revolution* came fourth with disruptions in various industries which include banking, energy, and communications. Despite the disruptions, the technologies opened some doors in areas of space research and biotechnology (Ooi et al., 2018). Currently, we are in the 4IR or industry 4.0 (Ooi et al., 2018).

The three industrial revolutions helped to build the foundation of the 4IR as articulated by Schwab (2017). Industry 4.0 is defined as

“the blurring of boundaries between the physical, digital, and biological worlds. It is also viewed as the fusion of advances in artificial intelligence (AI), robotics, the Internet of things (IoT), 3D printing, genetic engineering, quantum computing, and other technologies Industry 4.0 is the collective force behind various products that are fast becoming indispensable to modern life through the application of AI and machine learning. Products like the GPS systems that suggest the fastest route to a destination, the ability of Facebook to recognize human faces as well as your face and tag a person in a friend’s photo” (Schwab, 2017). Countries, development organisation and businesses in the world are planning as well as preparing on the impact of the 4IR on humanity and business. However, the general impact of the revolution on the society has not been discussed in deeply and in detail, let alone the impact of AI on poverty (Mhlanga, 2020a, Dunga, 2019, Deloitte, 2018, Berce, 2016).

All the previous industrial revolutions led society to go “*through painful processes of adaptation, for example from rural, largely agricultural societies, to urban, industrial societies, and then to post-industrial societies dealing with the loss of traditional industries and sources of employment*”(Blinov, 2014).

The impact of the 4IR on the society will result not only in the loss of jobs but a marginal shift on how public and private goods and services are delivered (Dunga, 2019, Radziwill, 2018). Smith (2020) in a study getting value from artificial intelligence in agriculture AI is beginning to live up to its promises of delivering real value due to the availability of relevant data, computational ability and algorithms. Smith (2020) argued that AI applications can help to improve productivity in farming through improving the detection of diseases and the precision of measurements about what is happening on the farm. Eli-Chukwu (2019) in another study indicated that the usefulness of AI applications has been evident in the agricultural sector. In the study, Eli-Chukwu (2019) stated that AI plays critical roles to solve some of the challenges affecting the agricultural sector in their endeavour to maximise yields. Therefore, this study is investigating the impact of AI on poverty.

1.1.The difference of the industry 4.0/4IR to other revolutions

Industry 4.0 is unique when it is compared to other previous Industrial Revolutions (Schwab, 2015). According to Schwab (2017), industry 4.0 has dramatic differences with the other three industrial revolutions. The scale, scope, and complexity and the transformation of the industry 4.0 will be unique to all other revolutions. It will be something humankind has never experienced before (Schwab, 2017). Industry 4.0 is not just an extension of the previous industrial revolution, but it is a new distinct revolution (Berce, 2016; Schwab, 2017).

The first notable difference of the industry 4.0 to other past revolutions is the production of information. In the industry, 4.0 people can come up with new information as well as generating new knowledge in the mining of information (Berce, 2016; Schwab, 2017). This is enhanced by the possibilities available for many people to be connected by mobile gadgets with strong *processing power, storage capacity, and unlimited access to knowledge* (Banwari, 2018; Kravchenko and Kyzymenko, 2019). In a way, the continuous data accumulation and analysis is permitting the intelligence of machines to improve. The other issue which makes the industry 4.0 to be unique from other industrial revolutions is the fact that the industry 4.0 is not just massive advances in technology will also come with a transformation of the existing relationships in the production process (Brown-Martin, 2018; Soh and Connolly, 2020). Industry 4.0 is allowing the manufacturing sector to be in the class of the information age through permitting communication at all the stages of production. Also, industry 4.0 is initiating new economic form in many sectors, the sharing economy (Mhlanga, 2020a, Mhlanga and Moloi, 2020b, Kravchenko and Kyzymenko, 2019). Services such as shared basketballs and toys; transport this shows how revolutionary the shared economy will become in the industry 4.0 (Mhlanga and Moloi, 2020a).

On the other hand, some researchers believe that industry 4.0 will result in more inequality due to its threat in disrupting labour markets. It is argued the continuous growth in automation, robots and computers will take the jobs of workers in many industries (Berce, 2016). The most worrying aspect is that there is the increased danger of the disappearance of low-skill/low-pay jobs which will cause a lot of challenges for the poor which will lead to a rise in social tensions (Davis, 2016). However, in its strict sense, the issue of inequality is not unique to the industry 4.0, in history, all other previous revolutions always started with *huge inequality followed by periods of political and institutional change* (Schwab, 2017). However, the most worrying fact is that in the industry 4.0 it is not only the movement of labour from one sector of the economy to another but the existence of robots and computers that will replace human capital in short, taking the jobs of people. (Schwab, 2015, 2017). The other aspects the technological revolution will have an impact on are issues related to material or ideological changes caused by the introduction of new devices or new systems which will have an impact on reshaping the culture of humankind. Figure 1 below explains the four industrial revolutions from the first to the current revolution.

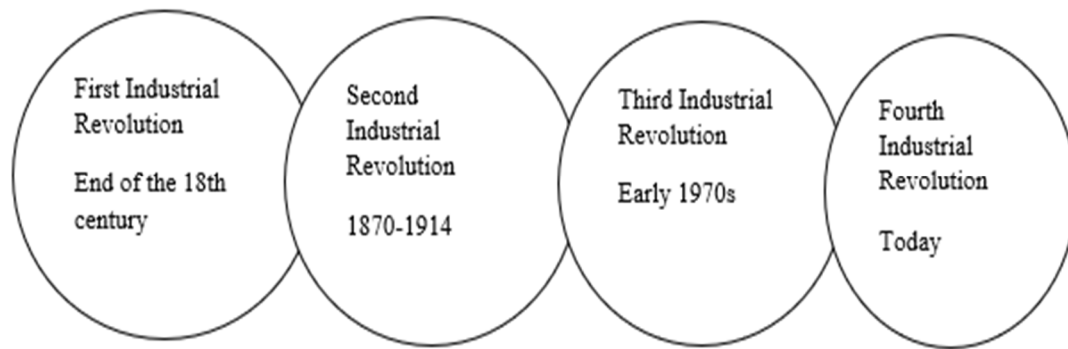


Figure 1: Industrial revolutions

The four industrial revolutions are clearly shown in the diagram above from the first industrial revolution to the last industrial revolution of today. The first industrial revolution started towards the end of the 18th century followed by the second industrial revolution which happened between 1870 and 1914. In the early 1970s, the third industrial revolution happened. The fourth industrial revolution is happening today with various technologies that are driving it such as AI, robotics, blockchain, distributed ledger technology among several other technologies.

2. Literature Review

2.1. A brief history and definition of AI

The Idea behind the subject of AI began in 1955 with John McCarthy who assumed that all the aspects of learning and the notable domains of intelligence can be simulated by a machine (Wisskirchen et al., 2017; Mhlanga, 2020a). On the other hand, Haenlein & Kaplan (2019) stated that “although it is difficult to pinpoint the roots of AI, however, it is possible to trace back to the 1940s, specifically 1942, when the American Science Fiction writer Isaac Asimov published his short story Run around. The plot of Run around a story about a robot developed by the engineers. The word “Artificial Intelligence” was then officially coined in 1956 Marvin Minsky and John McCarthy one of the computer scientists at Stanford”.

The term artificial intelligence is explained as the investigation “*of intelligent problem-solving behaviour and the creation of intelligent computer systems. In other words, AI describes the work processes of machines that would require intelligence if performed by humans*” (Wisskirchen et al., 2017). As outlined by Wisskirchen et al., (2017) AI has two kinds which are weak AI and strong AI. With weak AI “the computer is merely an instrument for investigating cognitive processes the computer simulates intelligence”. Strong AI, on the other hand, entails “the processes where computers are intellectual, self-learning processes. Computers can understand through the right software/programming and can optimise their behaviour based on their former behaviour and their experience” (Wisskirchen et al., 2017). Strong AI includes automatic networking with other machines, which leads to a dramatic scaling effect (Buchanan, 2005). The most notable economic disciplines of AI are deep learning, robotization, dematerialisation, the gig economy and autonomous driving cars among others (Wisskirchen et al., 2017).

Benko & Sik Lányi (2011) insinuates that even though AI has been studied for decades but it is still one of the *most elusive subjects in computer science* as a result of the fact that the subject is large and nebulous. It is believed that AI ranges from machines which can think to search algorithms used to play board games. In other words, it is insinuated that AI has applications in nearly all ways humans use computers in society. AI is used in subtler ways which include examining purchase histories as well as influencing marketing decisions (Benko and Sik Lányi, 2011). According to Buchanan (2005) *robots have always been part of the public's perception of intelligent computers but early robotics efforts had more to do with mechanical engineering than with intelligent control*. However, through the power of AI robots are becoming more powerful vehicles for the testing idea across the world about intelligent behaviour. However, it has been argued that *AI is not just about robots. It is also about understanding the nature of intelligent thought and action using computers as experimental devices* (Buchanan, 2005).

2.2. The theoretical definitions of poverty

Poverty over the years has been defined with a bias towards monetary aspects, however, with time scholars are beginning to shift the definition of *poverty to multidimensional issues like political participation and social exclusion* showing that poverty is a multidimensional phenomenon (Davis and Sanchez-Martinez, 2014). This means that poverty is not a direct result of one factor but a combination of factors. As a result, the United Nations (UN) defined poverty in two aspects which are the absolute poverty and overall poverty. Absolute poverty is defined as a condition where people are *deprived of basic human needs like food, health, shelter, safe drinking water, sanitation facilities, education and information* (Davids and Gouws, 2010; D Mhlanga, 2020b). As a result, poverty is as a result of many factors, not only income (Davids and Gouws, 2010). Also, overall poverty is defined as a condition where people are not able to have access to income and other productive resources. Overall poverty is characterised but not limited *“to hunger and malnutrition, ill-health, inability to access education, a rise in morbidity and mortality from illness, shortage of housing, unsafe environments, social exclusion and discrimination”* (Davis and Sanchez-Martinez, 2015). Overall poverty also *“involves a lack of participation in decision making in civil, social and cultural life”* (Davis and Sanchez-Martinez, 2014).

The UN also came up with another definition of poverty, the multidimensional poverty index (Mhlanga, 2020b). The definition by the UN in 2010 involves many issues such as *education, health, standards of living and many other variables*. In 2013, the Joseph Rowntree Foundation (JRF) defined poverty as *a condition where people's material resources are not enough to satisfy the minimum needs with social participation is included* (Mhlanga, 2020b, Mhlanga, and Ndhlovu). The World Bank stressed much on *consumption and income of individuals as major variables which can render a person to be poor especially if the individual fails to reach a prescribed income or consumption threshold commonly known as the poverty datum line* (Davids and Gouws, 2010). From the various definitions of poverty, the study will investigate how AI can have an impact on poverty from various dimensions.

2.3. Poverty statistics in the world

The battle against poverty is going on the world over, although there was a decline in global extreme poverty, the pace is slow. *The portion of the population in the world living in extreme poverty declined to 10 per cent in 2015, down from 16 per cent in 2010 and 36 per cent in 1990*

(Guterres, 2019; World Bank, 2019). The statistics show that the world is not on track in attaining the goal of *reducing the world's population living in extreme poverty by 2030* (World Bank, 2019). However, the baseline projections suggest that *6 per cent of the world population will still be living in extreme poverty in 2030, missing the target of ending poverty* (Guterres, 2019; World Bank, 2019). *People who live in extreme poverty continue to face deeply entrenched deprivation which is sometimes exacerbated by violent conflicts and vulnerability to disasters. It is argued that tough social protection systems and massive government spending on key services can help those in poverty to come out of the poverty brackets. However, there is a need for strengthening and scaling up these services* (Guterres, 2019). According to Guterres (2019) *despite having a job 8 per cent of households are still living in extreme poverty in the year 2018* (Guterres, 2019). The situation is worse in Sub-Saharan Africa where a portion of the poor working population is approximately 38 per cent in 2018 (Guterres, 2019).

The World Bank also supported the fact that poverty is still concentrated in Sub-Saharan Africa. In 2019 the World bank Indicated that despite a decline in poverty rates in all the regions in the world, but the rate of progress was uneven (World Bank, 2019). The World Bank estimated that approximately more than half of the extremely poor people live in Sub-Saharan Africa (World Bank, 2019). In 2015, it was also estimated that the portion of poor households in Sub-Saharan Africa rose by 9 million, while 413 million people are surviving on less than US\$1.90 a day. This was more than all other regions in the world combined (World Bank, 2019; Mhlanga, 2020b).

It is also believed that if the trend continues, *by 2030, nearly 9 out of 10 extreme poor will be in Sub-Saharan Africa* (Moffitt, Danziger and Haveman, 2019). *The other worrying aspect is that bulk of poor people in the world reside in rural areas. Majority of these people are poorly educated, employed in the agricultural sector, and under 18 years of age as articulated by the World Bank* (World Bank, 2019, Mhlanga, 2020c). The World Bank also indicated that the work to end extreme poverty is still in progress with many challenges present due to slow growth rates in many parts of the world (Moffitt, Danziger and Haveman, 2019; World Bank, 2019). This study, therefore, intends to investigate how can the use of AI help to address the problem of poverty which is affecting the whole world.

3. Empirical Literature Review

The subject of AI and poverty is relatively new because of the empirical literature on the impact of AI on poverty is still scarce. Smith (2020) in a study getting value from artificial intelligence in agriculture *reasoned that AI is beginning to live up to its promises of delivering real value due to the availability of relevant data, computation and algorithms*. In the study, Smith (2020) discusses the value of agriculture from AI in the next decade. In the study, it was discovered that AI applications can help to improve productivity on the farm through improving the detection of diseases and the precision of measurements about what is happening on the farm. *The study also indicated that in many cases robotics and automated systems will remove much of the need for human decision-making and improve farm efficiencies and farm health. Also, AI helps the farmers to harness the value of information distributed throughout supply chains, including farm data*.

In another study, Dharmaraj & Vijayanand (2018) argued that the fact that the population is increasing estimated to increase by 2 billion in 2050, it means that AI is important to improve

the efficiency of farming practices. Dharmaraj & Vijayanand (2018) *also indicated that a direct application of AI or machine intelligence across the farming sector could act to be an epitome of the shift in how farming is practised today.* Also, the study highlighted that farming solutions which are AI-powered in many occasions enable a farmer to do more with less, which enhances the quality, also ensuring that farmers will go to markets very fast that enhancing quick GTM (go-to-market strategy) strategy for crops.

Again Vincent et al., (2019) argued that the world population is expected to increase to 2 billion in 2050, while the arable area is expected to grow by only 5 per cent. As a result, smart and efficient farming techniques powered by AI and machine learning are necessary to improve agriculture productivity. The study also highlighted that the suitability of agricultural land is among several critical tools that drive agricultural development. As a result, AI performs a big role in agriculture an alternative in the collection and processing of information through wireless sensor networks. The availability of wireless sensor networks is also allowing the development of low-cost sensor devices with the Internet of Things (IoT) with the power of being appropriate tools for automation and decision making in agriculture. Vincent et al., (2019) believes that integrating sensor networks with AI systems Like neural networks and Multi-Layer Perceptron (MLP) can help assess the appropriate land for agricultural purposes

Eli-Chukwu (2019) in another study indicated that the application of AI has been evident in the agricultural sector. In the study, Eli-Chukwu (2019) stated that AI plays critical roles to solve some of the challenges affecting the agricultural sector in their endeavour to maximise yields. Some challenges affecting the agricultural sector where AI can play a critical role is to ensure that there are proper soil treatment, disease and pest infestation control, ensuring that big data requirements are solved, problems of low output can also be addressed, and knowledge gap between farmers and technology can be reduced. Eli-Chukwu (2019) stated that AI can help to solve some of these challenges in agriculture due to its flexibility, high performance, accuracy, and cost-effectiveness.

Zavadskaya (2017) investigated the application of AI finance particularly issues to do with portfolio management, *bankruptcy prediction, credit rating, exchange rate prediction and trading.* The main idea objective of the study was the stock market prediction, and whether Artificial Neural Networks (ANN) as proxies for AI, could offer an investor more accurate forecasting result. Zavadskaya (2017) discovered that ANN performed well in the prediction of results for investors compared to many models. The study also discovered that combining *AI with the concept of big data, Google Trends search as a measure of market sentiment is valuable in the modelling of returns.*

Cossy-Gantner et al., (2018) also stated that the field of AI has been developing in the last 60 years and various applications of AI have been utilised in high-income countries and their use in poor countries is still a huge challenge. Cossy-Gantner et al., (2018) went on to argue that even though AI still has problems in its application in low-income countries it's present huge promises in the transformation of healthcare in poor nations

4. Research Methodology

The study used secondary research to investigate the impact of AI on poverty in the fourth industrial revolution. To analyse objectively the impact of AI on poverty, the study used unobtrusive research techniques. Elo et al., (2014) defined unobtrusive research as the methods

of data collection where the researcher does not interfere with the subjects under investigation. This is mainly because the methods are not obtrusive (Colorado State University, 1997). The study made use of content analysis which is the study recorded information in texts, media or physical items. The advantage of content analysis is its non-invasive nature when analysing a social phenomenon (Colorado State University, 1997). Content analysis is used in specifically three different approaches which include the *conventional, directed and summative*. According to Elo et al., (2014) the three approaches help in the interpretation of meaning from the content of text data permitting them to conform to the naturalistic paradigm. The current study was mainly premised on the summative content analysis involves the counting and comparisons of keywords and interpret the context in the keywords or content, followed by the interpretation of the underlying context (Colorado State University, 1997).

Results and discussion

The impact of AI on poverty

AI technologies can play a central role in the achievement of the Sustainable Development Goals (SDGs). This study is assessing the impact of AI on poverty, which is goal one of the Sustainable development goals, end poverty in all its manifestations.

4.1. Poverty maps and data collection

The World Bank estimates *that 736 million people live in extreme poverty worldwide, and half of them are in just five countries which are India, Nigeria, Democratic Republic of Congo, Ethiopia, and Bangladesh*. The World Bank and the UN in their fight against poverty rely heavily on research and data to measure progress towards this goal (Weber, 2019). The Decentralized AI Alliance (DAIA) indicated that the impossibility to collect data is a consequence of poverty itself (DAIA, 2020). *DAIA (2020)* believes that location is a fundamental variable in the objective to *end poverty in all its forms everywhere*. It is believed that countries are not collecting as much data and scaling up traditional household surveys to identify the number of poor people and the regions where these people are located. This is also worsened by the fact that traditional household surveys are expensive to many nations (DAIA, 2020).

However, AI can assist to change this. In a recent study by a team at Stanford University is using satellite images to provide an alternative to map poverty (Schmidt, 2020). In a study which focused on five African countries namely, Nigeria, Tanzania, Uganda, Malawi and Rwanda social scientists and computer expert came up with the idea of using high-power satellites to detect poverty through an analysis of their images. In a way to corroborate the predictions from the study, the researchers used accurate survey data (Schmidt, 2020). In a way to effectively map poverty, AI can combine high-resolution satellite imagery with powerful machine learning algorithms and predict how rich or poor specific locations around the world are. AI can help to effectively provide information like the distance from the nearest water sources, the nearest urban market or where the agricultural fields are and many other important variables used when measuring poverty (DAIA, 2020).

The Qatar Computing Research Institute (QCRI), which is part of Hamad Bin Khalifa University, is also collaborating with several organisations such as the World Bank and UN to tackle poverty among other global problems using AI (Weber, 2019). QCRI also developed the

AI for Digital Response (AIDR) platform, which analyses data during disasters, such as the hurricanes like the Hurricane Dorian. These analyses help a lot to map the areas where help is needed the most and the level effort needed to respond to a disaster (Weber, 2019). The QCRI also work directly with relief organisations in the development of technologies used in the analysis of big data in times of disaster in a way to analyse the conditions for the allocation of resources (Weber, 2019). With machine learning, the QCRI is the produces poverty maps by utilising anonymous advertising data from Facebook (Weber, 2019).

4.2.The Impact of AI on Agriculture in Rural Areas

The definition of poverty as highlighted before is a multifaceted phenomenon in other words poverty is multidimensional. It manifests itself in lack of income, lack of education and sometimes lack of social assistance (DAIA, 2020; DFID, 2018). This mostly affects rural areas where the majority of the poor people reside. According to the World Bank, agriculture is the sources of livelihood in areas in areas where poverty is more prevalent (Poverty and Shared Prosperity 2016). According to DAIA, (2020) AI can address the problem of poverty through improving farming soil cultivation for growing crops and the rearing of animals as a way of providing food and other important products (DAIA, 2020). Through AI applications robots can now help farmers to harvest crops and predicting the best ways for farmers to grow different crops.

Schmidt (2020) stated that using robotics, AI becoming an important variable in solving world hunger. Schmidt (2020) believes that *there is progress being made by corporations and university programs such as Google and Stanford University's Sustainability and Artificial Intelligence Lab*. These organisations are coming forth with AI programs in agriculture which are doing a lot to improves farming, helping in the identification of diseases, prediction of crop yields and location of areas prone to scarcity (Schmidt, 2020). One example where AI is used through FarmView programme created by researchers from Carnegie Mellon University (CMU) to help farmers to grow more food using the same number of crops. This effort is being applied to come up with rapid solutions to the critical problem of paid rise in population. It is estimated that by the year 2050, approximately 9.8 billion people will live on the planet, and this will increase food scarcity making this topic very critical. However, *the availability of AI will help to improve farming methods sensing and robotics technologies to improve plant breeding and crop management* (Schmidt, 2020). Researchers are busy to collect a lot of information using *drones, robots and stationary sensors* to increase yields of drought and heat resistant crops that can thrive in famine-stricken nations (DAIA, 2020; Schmidt, 2020). Through AI technology researchers and machine learning technologies data is analysed to determine what factors yield more sorghum (DAIA, 2020; Schmidt, 2020).

Another example of where AI is helping a lot in agriculture is through industry PlantMD. PlantMD is an application created by high school students Shaza Mehdi and Nile Ravanell. This application allows a farmer to detect plant diseases (Schmidt, 2020). This application was built using Google's TensorFlow, an open-source machine learning library (Schmidt, 2020). The PlantMD application was influenced by Nuru one of the applications built by a research team at Penn State University Pennsylvania called Plant Village alongside the International Institute of Tropical Agriculture. The application (Nuru) was created to combat disease and pest susceptibility in cassava, one of the crops that feed half a billion Africans daily (DAIA, 2020; Schmidt, 2020). Farmers had difficulties in inspecting and managing every crop. *As a*

result of the availability of AI, machine learning is now used to increase efficiency in the process of disease and pest control. *“A machine learning model was trained using thousands of classified cassava images and the model was turned into an application where farmers can send images of their crop and receive information which gives them the ability to identify diseases with options available to manage the diseases”* (DAIA, 2020). In this way, AI is assisting African agriculture to be sustainable which can help agriculture to feed the people. Similarly, *Stanford University is utilizing machine learning to understand and predict crop yields in soybeans*. Moreover, it is believed that machine learning can also assist in discovering places in developing and underdeveloped nations with food insecurity issues through satellite technology.

4.3.The Impact of AI in Education

Poverty is usually associated with the inability of households to have formal education. The World Bank estimates that about 39 per cent of the world poorest do not have formal education. Aspects that hinder access to education for many households is purely the cost factor and capacity of the institutions of higher learning. Many institutions have a prescribed number of people they can accommodate (Wong, 2020). AI can assist in raising the levels of education for the poor children the various methods which include adapted learning techniques using computer algorithms to encourage interaction with the learner as well as coming up with an education that is tailor-made for the needs of each learner (DAIA, 2020). Using AI, it is highly possible to discover the specific learning needs of each learner and be able to satisfy these requirements using various methods of learning. In other unique circumstances, intelligent chat boards are used as tutors breaking the money barrier to education to pupils who come from poor areas which will help to address access issues finally be able to address inequality at the same time.

According to a study “COVID-19 and the Digital Transformation of Education: What We Are Learning in South Africa”, Mhlanga and Moloi (2020a) found out that despite the existence of social distancing restriction necessitated by COVID-19, technology helped many people to be able to have access to classes through online education. The study also found out that technology can increase access to education especially if education move from face to face type of education to online education where space is not a limiting factor (Bennington-Castro, 2017). One of the education projects where AI is assisting in education is through the social enterprise Eneza Education where AI is used in the tutoring millions of rural students in Kenya, Ghana, and Côte d’Ivoire. In this way, AI is helping a lot in the achievement of quality education. This also enables education to be inclusive and equitable creating and promoting lifelong learning opportunities for all (DAIA, 2020).

4.4.AI and Digital Financial inclusion

Digital financial inclusion is viewed as a way of reaching out to the households who are not financially active, that is those who are not able to enjoy formal financial services that are designed to meet their needs (Mhlanga, 2020a; Alameda, 2020). Mhlanga, (2020a) argued that people who are excluded from the formal financial sector are women, youth, and the poor especially those staying in rural areas. The popularity of digital financial inclusion increased when M-PESA become one of the success stories in the payment innovations that started in Kenya (Wang & He 2020). In Asian countries like China digital financial inclusion is viewed

as more than payment innovations which include digital investment, payments and investment (Van Hove and Dubus, 2019; Wang and He, 2020). The importance of digital finance is its ability to utilise information communication technology (ICT) in increasing the scale and use of financial service by the poor and those excluded from the formal financial market (Mhlanga, 2020a, Lauer and Lyman, 2015).

The coming in of ICT and AI allowed financial inclusion to become digital and to allow groups of vulnerable people to be able to access finance (Visser and Prahalad, 2013). Mhlanga, (2020a) agree with Wang and He, (2020) that for business to be the activity to be successful when it is done with people at the bottom of the pyramid, radical innovations such as the use of AI is one of the requirement. The application of AI in digital financial inclusion makes it different from the traditional financial inclusion because with digital financial inclusion, there is a massive reduction in transaction costs, especially in the rural areas as a result of lower marginal costs since with digital financial inclusion service provider necessarily don't need to have physical outlets (Wang and He, 2020). Also, the use of T AI and various ICT tools overcomes the major problem of traditional financial inclusion which is information asymmetry (Mhlanga, 2020a, Gomber, Koch and Siering, 2017).

Various online services and products provide a vast amount of information to customers which could not be accessible without the use of digital services (Mhlanga, 2020a). Peric, (2015) stated that the benefits of digital financial inclusion access to formal financial services by the poor people those who were financially excluded, the other benefit is that, digital financial inclusion helps to preserve the disposable incomes of the households because digital financial services and products are usually offered at a lower cost to the customer and the service provider. The use of AI also allows customers to be able to transact in irregular small amounts to assist them to manage their uneven incomes (Mhlanga, 2020a, Koh, Phoon and Ha, 2018). The other benefit of digital financial services is that it helps to reduce the risks of loss, theft, and other financial crimes posed by cash-based transactions (Mhlanga, 2020a; Muneeza, Arshad and Arifin, 2018). Also, digital financial inclusion promotes economic empowerment by allowing the accumulation of assets for women, the youth, and the rural people which increases their economic participation (Mhlanga, 2020a; David-West, 2015).

5. Conclusions and Policy Recommendations

The purpose of the study was to critically investigate the influence on AI on poverty reduction. Through using content analysis, the study found out that AI is increasingly delivering real value due to the availability of big and relevant data. AI is becoming central in the debate on how to fight poverty and hunger in areas of data collection through poverty maps, agriculture, education, and financial inclusion. It is believed that countries are not collecting as much data and scaling up traditional household surveys to identify the number of poor people and the regions where these people are located. However, AI is assisting to change this scenario. The research team at Stanford University is using satellite images to provide an alternative to map poverty, to identify the regions where poverty is more concentrated. Also, through the use of robotics and AI programs such as Google and Stanford University's Sustainability and Artificial Intelligence Lab, are coming forth with AI programs in agriculture which are doing a lot to improves farming, helping in the identification of diseases, prediction of crop yields and location of areas prone to a scarcity among several other notable progress in education. Therefore, the study recommends that governments, development institutions and other

organisations which are striving to fight poverty do invest more in AI as well as adopting and scaling up its use of as it presents benefits in the quest to ensure that poverty is reduced.

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