LIMPOPO
PROVINCIAL GOVERNMENT
REPUBLIC OF SOUTH AFRICA

DEPARTMENT OF
ECONOMIC DEVELOPMENT, ENVIRONMENT AND TOURISM

PROFILING KNOWLEDGE MANAGEMENT IN LIMPOPO PROVINCE MOVING TOWARDS FOURTH INDUSTRIAL REVOLUTION: WORKING TOWARDS KNOWLEDGE BASED ECONOMY [2022]

Economic Research

TABLE OF CONTENTS

LIST OF ABBREVIATIONS

1IR	**First Industrial Revolution**
2IR	**Second Industrial Revolution**
ADP	**Advanced Digital Production**
3IR	**Third Industrial Revolution**
BBBEE	**Broad-Based Black Economic Empowerment**
DBE	**Department of Basic Education**
DLT	**Distributed – Ledger Technology**
ECD	**Early Childhood Development**
GDP	**Gross Domestic Product**
IDR	**Industrial Development Report**
IoT	**Internet of Things**
ISID	**Inclusive and Sustainable Industrial Development**
ITU	**International Telecommunications Union**
PPP	**Public Private Partnership**
LDCs	**Less Developed Countries**
NDP	**National Development Plan**
NTIP	**National Tooling Initiative Programme**
SDL	**Skills Development Levy**
SMMEs	**Small Medium and Micro Enterprises**
TVET	**Technical & Vocational Education & Training**
UN	**United Nations**
UNIDO	**United Nations Industrial Development Organization**
YES	**Youth Empowerment Service**

LIST OF TABLES

LIST OF FIGURES

EXECUTIVE SUMMARY

INTRODUCTION

ICT is key to addressing unemployment, equality, health and other poverty related issues worldwide. According to UN (2021), human development in recent decades has been accompanied by rapid changes in technology and an increasing proliferation of digitalized devises and services. The pace of change seems likely to accelerate because of frontier technologies such as artificial intelligence (AI), robotics, biotechnology, and nanotechnology.

Limpopo Province is one of the rural provinces in South Africa in which the inequality, unemployment, poverty and crime is very high. Some of rural villages in Limpopo are without electricity hence they cannot have access to network. The National Development Plan (2030) revealed that developments in science and technology are fundamentally altering the way people live, connect, communicate and transact, with profound effects on economic growth and development. The National Development plan also indicates that science and technology are key to equate economic growth, because technological and scientific revolutions underpin economic advances, improvements in health systems, education and infrastructure.

BACKGROUND INFORMATION

The Department of Economic Development, Environment and Tourism plays a critical role in the promotion of economic development. The Department recognises that it is impossible to attain positive economic growth without inclusive ICT coverage in the Province. The Fourth Industrial Revolution has potential to catalyse South Africa's path to attaining the goals of the National Development Plan.

South Africa's ICT policy sets out the vision for ICT development and is associated with national development goals as set out in the National Development Plan (NDP). The aims of the NDP include eliminating poverty and reducing inequality, growing an inclusive economy, building capabilities, enhancing the capacity of the state, and promoting leaders who work together to solve complex problems throughout society. The objectives of the NDP include quality education and skills development for all South Africans by 2030. One of the milestones for the NDP includes making high-speed broadband internet available to all citizens at competitive price (Government Communication and Information System 2013, as cited in Chisango & Lesane 2017).

PROBLEM REVIEW

The problem in context suggests themes that are assumed the key in addressing poor ICT development in the Province. For effective ICT development, the following themes need urgent attention:

Cost of doing business

Cost effectiveness is widely viewed as the primary constraint on growth of SMMEs. This includes connectivity, communication and daily transactions. The Limpopo Provincial Government shall play a substantial role in ICT development in addressing disparities between those that are in rural villages and those that are living close and in towns.

Availability of electricity and uninterrupted electricity is key to development

Some communities in Limpopo Province do not have access to electricity. It is impossible to access the ICT without electricity. In some cases, power outages also hinder developmental progress as computers, internet and cellphones depend on reliable supply of electricity.

Supply networks

Supply networks are enforced by connectivity. Poor connectivity force those that are doing business in rural areas to drive kilometers to purchase stock or any kind of transactions. This increases cost of doing business, as fuel is too expensive.

Skills development

Skills development is crucial to the majority of young and old citizens for them to gain knowledge on how to manipulate the technology.

Affordability

Due to high poverty rate in Limpopo, affordability of data and any advanced technologies is a challenge to many people.

Accessibility

According to UN Report (2021), technology is accessible considering language and physical conditions of users. Frontier technologies comes in foreign languages and it is difficult for those who do not master English language.

Availability

Availability of technology in both rural and urban areas is very important. Frontier technologies have huge potential for improving people's lives.

PROBLEM STATEMENT

The Limpopo Provincial Government identified ICT sector as one of the sectors that can assist in enhancing its economic growth path. The Limpopo Provincial Economy is lagging behind in ICT technology development. This lack of innovations is further creating huge disparities in the Province. The emergence of COVID-19 has exposed the Province as the majority of people are residing in rural areas where technological development is lacking. The introduction of virtual training, teaching, conferences and meetings is problematic to some in the Province due to lack or poor connectivity.

OBJECTIVES AND SCOPE

The research objectives

- Profile ICT coverage in Limpopo Province;
- Determine the percentage of people residing in Limpopo that are not able to access the ICT due to unavailability of electricity and those that are able to access ICT; and
- Review the Presidential Commission Report on fourth industrial revolution.

The Scope

The study analyzed the current state of affairs on ICT development and coverage in Limpopo Province. The study provides an overview of the extent of coverage of ICT and how the Province is responding to fourth Industrial Revolution.

METHODOLOGY

The study was based on secondary and primary data. The data sourced from municipalities, Statistics South Africa, Global Insight and other official data generators. The survey was limited

to the district and local municipalities. Only local economic development personnel participated in the survey.

FINDINGS

- Income Poverty – many people in Limpopo Province cannot afford new goods or service, particularly those in rural areas. In this case, the barriers are not necessarily technological but economic and social.
- Digital divide – many areas in Limpopo Province lack adequate digital infrastructure and for most of their people internet costs are prohibitive.
- Shortage of skills – many frontier technologies require at least literacy and numeracy skills. Other technologies require digital skills, including the ability to understand digital media, to find information, and to use these tools to communicate with others.
- Sixty-eight point seventy five (68.75%) of the participants agreed that ICT and SMMEs growth are a priority in this Local Municipality. On the other hand, 31.25% of the participants disagreed with the statement.

- Eighty seven point fifty percent (87.50%) agreed that priorotising ICT and SMMEs would assist the Local Municipality to achieve the 2030 goals, while only 12.5% disagreed with the same statement.

- Ninety three point seventy five percent (93.75%) agreed that SMMEs in some areas in the Municipality do not have ICT tools because of the area in which they are located (e.g., non-availability of infrastructure like electricity and telephone lines, etc.), while only 6.25% disagreed with the statement.

- Eighty seven point fifty percent (87.50%) agreed that most of the areas in the Municipality still have challenges with network connections where even 3G does not work, while only 12.50% disagreed with the statement.

- Ninety three point seventy five percent (93.75%) agreed that the common types of ICTs that SMMEs use are computers, emails, faxes, photocopying machines, telephones and cell phones, while only 6.25% disagreed with the statement.

- Eighty one point twenty five percent (81.25%) agreed that most SMMEs do not have websites and do not use social networks for their businesses except for their personal reasons, while only 18.75% indicated that they disagreed with statement.

- Ninety three point seventy five percent (93.75%) agreed that SMME owners as well as their employees have limited ICT literacy, which makes them unable to integrate ICT into their business processes and strategies, while other SMMEs are challenges are high costs of ICT equipment, while only 6.25% disagreed with the statement.

- Sixty two point fifty percent (62.50%) indicated that they agreed that most SMMEs are not ready to adopt ICT because they have no skills to use it. On the other hand, only 37.50% indicated that they disagreed with the statement.

- Ninety three point seventy five percent (93.75%) agreed that SMMEs entrepreneurs within the Municipality need to be educated trained and supported in the use of the ICT applicable to enhance their business activities in order for them to take advantage of 21st century digital economies present, while only 6.25% disagreed with the statement.
- Ninety three point seventy five percent (93.75%) agreed that Information and Communication Technology (ICT) have the potential to add substantial value to the operations and the competitive position of Small and Medium-sized Enterprises, while only 6.25% disagreed with the statement.
- Ninety three point seventy five percent (93.75%) agreed that SMMEs that are successful often gain strategic positioning with internet, while only 6.25% disagreed with the statement.
- Ninety three point seventy five percent (93.75%) agreed that In order for SMMEs to compete on a much wider scale, the benefits of ICT needs to be taken into

consideration and awareness therefore needs to be raised by the Municipality, LEDET, LEDA, SEDA and all other stakeholders, while only 6.25% disagreed with the statement.

- Sixty-eight point seventy five (68.75%) of the participants agreed that ICT applications are not tailor made to the way SMMEs do business. On the other hand, 31.25% of the participants disagreed with the statement.

RECOMMENDATIONS

- Redesign/Alignment of skills ecosystem for agility necessary for 4IR learning
- The National Department of Basic Education should add ICT skills in the curriculum for both primary and high school leaners;
- Introduce computer literacy programme for educators and make provision of the software required in teaching and learning;
- Invest in relevant infrastructure – develop minimum infrastructure recommendation for schools for 4IR e.g. DBE must work towards every school having access to internet and no less than 25 computers and a printer, a dedicated room as a maker space for robotics curriculum and a basic set of music and art equipment.
- Establish a national project for teacher upskilling in digital literacy, critical thinking and creativity skills.
- Provide resources for urgent roll out of ECD learning centers.
- Resource the Department of Basic Education with 4IR Strategic Advisory Capacity,
- Rethink TVET college's roles as micro learning institutions providing 4IR relevant competencies.
- Resource and scale the NTIP initiative's model, approach and platform for the manufacturing sector and extend to other industries such as the creative industries, tourism and agriculture.
- Establish & resource Creative Industries Hubs and Clusters in townships and rural areas for Digital Content Production including animation, gaming, virtual reality and augmented reality, photography, graphic design, sound production, audio design, film & video production, digital art production, transmedia, digital marketing.

- Enabling SMME’s access to appropriate technology will enhance their growth and ability to scale.

CHAPTER 1

1. INTRODUCTION

ICT is key to addressing unemployment, equality, health and other poverty related issues worldwide. According to UN (2021), human development in recent decades has been accompanied by rapid changes in technology and an increasing proliferation of digitalized devises and services. The pace of change seems likely to accelerate because of frontier technologies such as artificial intelligence (AI), robotics, biotechnology, and nanotechnology.

Limpopo Province is one of the rural provinces in South Africa in which the inequality, unemployment, poverty and crime is very high. Some of rural villages in Limpopo are without electricity hence they cannot have access to network. The National Development Plan (2030) revealed that developments in science and technology are fundamentally altering the way people live, connect, communicate and transact, with profound effects on economic growth and development. The National Development plan also indicates that science and technology are key to equate economic growth, because technological and scientific revolutions underpin economic advances, improvements in health systems, education and infrastructure.

2. BACKGROUND INFORMATION

The Department of Economic Development, Environment and Tourism plays a critical role in the promotion of economic development. The Department recognises that it is impossible to attain positive economic growth without inclusive ICT coverage in the Province. The Fourth Industrial Revolution has potential to catalyse South Africa's path to attaining the goals of the National Development Plan.

South Africa's ICT policy sets out the vision for ICT development and is associated with national development goals as set out in the National Development Plan (NDP). The aims of the NDP include eliminating poverty and reducing inequality, growing an inclusive economy, building capabilities, enhancing the capacity of the state, and promoting leaders who work together to solve complex problems throughout society. The objectives of the NDP include quality education and skills development for all South Africans by 2030. One of the milestones for the NDP includes making high-speed broadband internet available to all citizens at competitive price (Government Communication and Information System 2013, as cited in Chisango & Lesane 2017).

3. PROBLEM REVIEW

The problem in context suggests themes that are assumed to be the key in addressing poor ICT development in the Province. For effective ICT development, the following themes need urgent attention:

3.1. Cost of doing business

Cost effectiveness is widely viewed as the primary constraint on growth of SMMEs. This includes connectivity, communication and daily transactions. The Limpopo Provincial Government shall play a substantial role in ICT development in addressing disparities between those that are in rural villages and those that are living close and in towns.

3.2. Availability of electricity and uninterrupted electricity is key to development

There are some communities in Limpopo Province who do not have access to electricity. It is impossible to access the ICT without electricity. In some cases, power outages also hinder developmental progress as computers, internet and cellphones depend on reliable supply of electricity.

3.3. Supply networks

Supply networks are enforced by connectivity. Poor connectivity force those that are doing business in rural areas to drive kilometers to purchase stock or any kind of transactions. This increases cost of doing business as fuel is too expensive.

3.4. Skills development

Skills development is crucial to the majority of young and old citizens for them to gain knowledge on how to manipulate the technology.

3.5. Affordability

Due to high poverty rate in Limpopo, affordability of data and any advanced technologies is a challenge to many people.

3.6. Accessibility

According to UN Report (2021), technology is accessible considering language and physical conditions of users. Frontier technologies comes in foreign languages and it is difficult for those who do not master English language.

3.7. Availability

Availability of technology in both rural and urban areas is very important. Frontier technologies have huge potential for improving people's lives.

4. PROBLEM STATEMENT

The Limpopo Provincial Government identified ICT sector as one of the sectors that can assist in enhancing its economic growth path. The Limpopo Provincial Economy is lagging behind in ICT technology development. This lack of innovations is further creating huge disparities in the Province. The emergence of COVID-19 has exposed the Province as the majority of people are residing in rural areas where technological development is lacking. The introduction of virtual training, teaching, conferences and meetings is problematic to some in the Province due to lack or poor connectivity.

5. SWOT ANALYSIS

Table 1.1: Swot Analysis

STRENGTH	OPPORTUNITIES
Availability of National Development Plan that support ICT development. Limpopo Broadband Network that is making a difference to some in Limpopo Province. Connectivity by SITA to government institution.	Private sector can benefit if forge ties with Limpopo Broadband Network. Huge undeveloped market to explore
WEAKENESSES	THREAT
Weak SITA connectivity Poor supplier networks due to poor ICT infrastructure development. Poor policy implementations. Lack of electricity in some areas and power outages High level of unemployment and poverty	High energy costs and outages Corruption as funds meant for ICT development end-up in wrong hands Theft of cables' and tower batteries.

6. OBJECTIVES AND SCOPE

The research objectives

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The Scope

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7. METHODOLOGY

The study was based on secondary and primary data. The data sourced from municipalities, Statistics South Africa, Global Insight and other official data generators. The survey was limited to the district and local municipalities. Only local economic development personnel participated in the survey. The following municipalities participated in the survey:

Table 1.2: Municipalities participated in the survey

Waterberg	Modimolle-Mookgophong
	Mokgalakwena
	Waterberg District Municipality
Sekhukhune	Makhuduthamaga
	Ephraim Mogale
	Fetakgomo/Tubatse
	Sekhukhune District Municipality
Mopani	Greater Letaba

	Baphalaborwa
	Greater Tzaneen
	Greater Giyani
	Maruleng
Vhembe	Musina
	Thulamela
	Collins Chabane
Capricorn	Molemole
	Blouberg
	Polokwane
	Lepelle-Nkumpi

CHAPTER 2

LITERATURE REVIEW

ICT AS ENABLER TO ECONOMIC GROWTH

Microsoft (2004) argued, “An economy’s ability to increase productivity is a powerful measure of its economic well-being”. Although economists have debated the relationship between ICTs and productivity, a growing body of data suggests that ICT investments – particularly when linked to fundamental organizational change – can have a substantial, positive impact on productivity. A study by the U.S Department of Commerce, for instance, concluded that information technology investments by U.S, firms in recent years had a widespread and lasting impact on the revival of U.S. productivity growth, suggesting that ICTs when used effectively can help organizations use resources more effectively and become more competitive (Microsoft, 2004).

An OECD (cited in Microsoft, 2004) concluded that while there are good grounds for believing that the use of ICTs is positively correlated to productivity growth, acquiring ICTs is not enough for countries to derive economic benefits. Microsoft (2004) argued that there are other factors such as the regulatory environment, the availability of appropriate skills, and the ability to spur organizational change, often have a substantial influence on the ability of firms to exploit the benefit of ICT.

In today’s increasingly integrated global economy, firms across the economic landscape, including those in developing countries, will need to learn how to acquire and use information effectively if the hope to succeed (Microsoft, 2004). Microsoft (2004) indicated that there is evidence that suggest that ICTs are beginning to provide a basis for productivity and economic growth in developing nations. ICTs are being used for instance, in Africa, India and other developing nations to create rural trading networks that connect local craftspeople directly with their customers (Microsoft, 2004).

How do we overcome the challenges of digitalization?

It is clear that the integration of digital technologies puts pressure on businesses and governments to adjust business models and regulatory frameworks. Other challenges

that need to be faced include a lack of data, inadequate skill sets, a lack of physical and digital infrastructure, and limited connectivity. This is especially true in developing countries and economies in transition (UN, 2020).

Several steps need to be taken at the policy and business level in order to respond to these challenges, and boost the kind of inclusive and sustainable industrial activity that leads to higher employment and economic growth (UN, 2020)..

These include the following:

- Reliable physical and digital infrastructure needs to be made widely accessible. At the moment 3.9 billion people — which corresponds to slightly more than half of the world population — have no or minimal access to the internet. The huge digital divide between developed and developing regions needs to be addressed in order to reap the full benefits of Industry 4.0.
- Both small and large enterprises need to find new, creative ways of organizing traditional manufacturing processes. They need to move from a “centralized” to a more “decentralized” production, in which a product might use intelligent machinery to communicate what needs to be done, instead of simply being “processed”.
- The ICT infrastructure requires new skill sets, for instance in mechatronics, digital medicine, precision agriculture, robot design, and smart grid design, as well as management. These skill sets cannot be created overnight, and require changes in education and vocational training.
- Businesses and governments need to adapt to a new reality, in which workers collaborate and coexist with machines (co-bots), and in which new industry sectors, such as digital medicine and precision agriculture, emerge.
- Agreement on new standards for the exchange of data pertaining to Industry 4.0 need to be found. These will likely be demanded by consumers and other stakeholders and might be related to the exchange and storage of big data, security and privacy, as well as to ethics guiding the relation between machinery and the work force.

THE PARADIGM SHIFTS: INDUSTRIAL REVOLUTIONS

First Industrial Revolution (1IR-1760 - 1840): The invention of the steam engine, the mechanization of simple tasks and the construction of railroads.

Second Industrial Revolution (2IR-Between late 19th and early 20th century): The advent of electricity, the assembly line and mass production.

Third Industrial Revolution (3rd IR-1960s): The development of semiconductors and mainframe computing in the 1960s together with personal computers and the internet

The 4th industrial revolution (4IR)

Driving the 4IR forward are rapid advances in digital technologies – artificial intelligence (AI), machine learning, robotics, additive manufacturing (3d printing), the Internet of Things (IoT), distributed – ledger technology (DLT) or block chain, and quantum computers – and their integration with bio-technology, nanotechnology and cognitive, social and humanitarian sciences (known as convergent and nature-like technologies). These technologies are also referred to as frontier technologies because they are innovative, fast growing, deeply interconnected and interdependent. (UNIDO 2020).

According to UNIDO (2020), the 4IR is leading to a paradigm shift that is profoundly altering how we work, live and interact. The 4IR is the fastest period of innovation ever experienced. Innovation is becoming more complex, multidisciplinary, collaborative, unplanned, unpredictable and disruptive. It is developing at an exponential rather than linear pace. Innovation cycles are accelerating and shortening, collapsing the product lifecycles. The exponential technologies progress of the 4IR will affect all countries, especially LDCs (UNIDO, 2020).

The emergence and diffusion of advanced digital production (ADP) technologies – artificial intelligence, big data analysis, cloud computing, Internet of Things (IoT), advanced robotics and additive manufacturing, among other – is radically altering the nature of manufacturing production, increasingly blurring the boundaries between physical and digital production systems (UNIDO, 2020)

According to UNIDO (2020), the creation and diffusion of ADP technologies, however, remains concentrated globally, with only weak development in most emerging economies. The Industrial Development Report (IDR), 2020 find that 10 economies – the frontrunners account for 90% percent of all global patents and 70 percent of all exports directly associated with these technologies. According to UNIDO Report (2020), another four (4) economies – the followers – actively engage in the technologies, though much more intensity that is modest. The rest of the world either shows very little activity (the latecomers) or fail to take part in the global creation and use of these technologies (the laggards) – UNIDO, 2020.

According to the UNIDO Repot (2020), new technologies are at the core of successful inclusive and sustainable industrial development (ISID). They enable the creation of new goods, which leads to the emergence of new industries. Moreover, they support an increase in the production, efficiency, which brings prices down and open consumption to the mass market – or increase profits, with possible follow-on effects for investments (UNIDO, 2020).

Table 2.1: Market Size Estimates of Frontier Technologies ($billions)

	2018	2025
Gene Editing	3.7	9.7
Nanotechnology	1	2.2
Blockchain	0.7	61
5G	0.6	277
Internet of Things (IoT)	130	1500
Drones	69	141
Solar PV	54	344
Big Data	32	157
Robotics	32	499
Artificial Intelligence (AL)	16	191
3D Printing	10	44
Source: UNCTAD based on data estimates from Froese 2018, MarketsandMarkets (2018), Sawant and Kakade (2018), Business Wire (2019), Chaudhary et al. (2019), GlobalNewswire (2019), MarketsandMarkets (2019), MarketWatch (2019a), MarketWatch (2019b), Raza (2019), Tewari and Baul (2019), Wagner(2020), Mordor Intelligence (2020).		

According to UN Report (2021), these technologies can be used to boost productivity and improve livelihoods; Artificial Intelligence (AI), for example combined with robotics can transform production and business processes. 3D printing allows faster and cheaper low-volume production and rapid, iterative prototyping of new products. As a group, these 11 technologies already represent a $350-billion market, and one that by 2025 could grow to over $3.2 trillion.

The UN Report (2021) indicates that finance companies have used these technologies, for example, for making credit decisions, and for risk management, fraud prevention, trading, personalized banking and process automation. The manufacturing sector has used them for predictive maintenance, quality control and human-robot combined work. The UN report (2021) also alluded to the fact that many of the major providers of these technologies are from the United States of America, which is home to major cloud computing platform. China is also a major producer, notably of 5G, drones and solar PV. For each of the technologies, these two countries are also responsible for 30 to 70 percent of patents and publications (UN Report, 2021).

According to the Presidency 4IR, the key lessons emerging from the 4IR country review are thus:

- The 4IR is a new epoch in social and economic life. It is driven by technological advancements that will deepen the connections between the biological, physical and digital worlds, therefore blurring or merging capabilities amongst these domains;
- Success in the 4IR will depend on our ability to unleash the full scientific, industrial and creative capabilities of South African society. In other words, the fundamentals of this revolution are consistent with the aims of our developmental state: economic competitiveness and societal wellbeing.
- However, failure to respond to the nature of these technological changes as well as their related infrastructural requirements, will pose a threat to South African industries; the relative wellbeing of South African people and their ability to participate in the world as equals;

- Despite the fact that South Africa is the most industrialized country on the African continent, it has not reaped the full benefits of previous Industrial Revolutions owing to an interrupted history. This has had adverse consequences for our people, banishing most to poverty and socio-economic exclusion;
- That we are capable is evidence by our history, which includes the ancient Kingdom of Mapungubwe, which was home to advanced scientific, artistic and industrial capabilities;
- The challenge of our time is therefore not simply about developing human capabilities but the recognition of the competitive landscape and our comparative place amongst nations;
- Cutting across country strategies is the centrality of the state: a focus on leveraging technology to address service delivery challenges; placing research, data management and science at the cross-cutting base of the state and public-private partnerships focused on scientific experimentation;
- Whilst the South African state is currently fiscally constraint, it has a unique opportunity to use its buying power to ignite the creation of industries of the future. This will simultaneously respond to the delivery of public goods whilst creating a clear, initial market for new industrialists, representative of the broader transformation vision; and
- Government departments will have crucial roles to play in aligning scientific and training efforts to clear industrial development priorities. This will require focus and a possible reduction in programmes.

THE GOVERNMENT AS DIRECTOR OF TECHNO-INDUSTRIAL OUTCOMES

According to the Presidency Commission, in its capacity as a direct role player in the 4IR, the state is characterized by its identity as the largest and most powerful purchaser in the country. To this end, the state's budget is predominantly spent on Education, Health, Social and Economic Infrastructure as well as Policing Services. This consumptive power is an opportunity for the state to determine the forms of 4IR production it is willing to reward/incentive through procurement. In so doing, the state as procurer, can directly

determine the emergence of 4IR industries that respond to its consumption appetite as well as the national economic development objectives.

The Presidency Commission also indicates that the drive to connect people and business to the Internet with digital infrastructure is urgent and imperative, if South Africa is to prepare for 4IR adequately. According to Presidency Commission, Sociologist Robert Merton coined the term “Matthew Effect” in 1968 describing a phenomenon where early advantage increases over time. Today the advancing impact of technology is unquestionable and we see that early adopters (innovators) have gained the lead and will continue to advance even further ahead of the rest. South Africa, therefore, cannot afford to allow the digital divide to deteriorate further into a digital chasm by continuing to lag behind technological progress.

According to the UN report (as cited in the Presidency Commission Report), countries in Africa are trailing ‘considerably behind’ developed markets in their share of the digital economy, a trajectory that is likely to continue, fueling a growing global digital divide. According to McKinsey (as cited in the Presidency Commission Report), African countries on average spend about 1.1% of GDP on investment in ‘going digital’ (including Internet infrastructure and network), while developed countries spend 3.2% of GDP. According the Presidency Commission Report, the latest International Telecommunications Union (ITU) data reveal that some 52% or 3.7 billion of the world’s population currently remain unconnected (ITU, 2018). The ITU also estimates that connecting the next 1.5 billion people will cost USD 450 billion.

According to the Presidency Commission Report, the following are main drivers of a South African 4IR strategy and plan:

1. **Technology, invention and innovation**

There is a need to embrace the convergence of the Physical, Cyber, and Biological and more deeply understand and leverage smart converged systems, models, and solutions. As a country, we need to determine our ability to lead in, compete in or leverage the race of supercomputing, open-source technology as well as the realities presented by Artificial Intelligence, the Internet of Things and smart systems in our social systems, governance,

business, we also need to look at where the 4IR presents opportunities for us to grow, improve or save existing sectors in our economy or innovate in new sectors.

The table below provides insight into the technologies and innovation from a global perspective:

Table 2.2: Technologies and innovation from a global perspective

Technology	Description
Artificial Intelligence and Robotics	Development of machines that can substitute for humans, increasingly in tasks.
Ubiquitous linked sensors	Also known as the "Internet of Things". The use of networked sensors to remotely connect, track and manage products, systems and grids.
Virtual and augmented realities	Next-step interfaces between humans and computers involving immersive environments, holographic readouts, and digitally produced overlays for mixed-reality experiences.
Additive manufacturing	Advances in additive manufacturing, using a widening range of materials and methods. Innovations include 3d bio printing of organic tissues.
Block chain and distributed ledger technology	Distributed ledger technology based on cryptographic systems that manage, verify and publicly record transaction data; the basis of "cryptocurrencies" such as bitcoin.
Advanced materials and nanomaterials	Creation of new materials and nanostructures for the development of beneficial material properties, such as thermoelectric efficiency, shape retention and new functionality.
Energy capture, storage and transmission	Breakthroughs in battery and fuel cell efficiency; renewable energy through solar, wind, and tidal technologies, energy distribution through smart grid systems; wireless energy transfer, and more.
New computing technologies	New architectures for computing hardware, such as quantum computing, biological computing or neutral network processing, as well as innovative expansion of current computing technologies.
Biotechnologies	Innovations in genetic engineering, sequencing and therapeutics, as well as biological computational interfaces and synthetic biology.
Geoengineering	Technological intervention in planetary systems, typically to mitigate effects of climate change by removing carbon dioxide or managing solar radiation.

Neurotechnology	Innovations such as smart drugs, neuroimaging and bioelectronics interfaces that allow for reading, communicating and influencing human brain activity.
Space technologies	Development allowing for greater access to and exploration of space, including microsatellites, advanced telescopes, reusable rockets and integrated rocket-jet engines.
Source: Trade & Industrial Policy Strategies, Department of Trade and Industry	

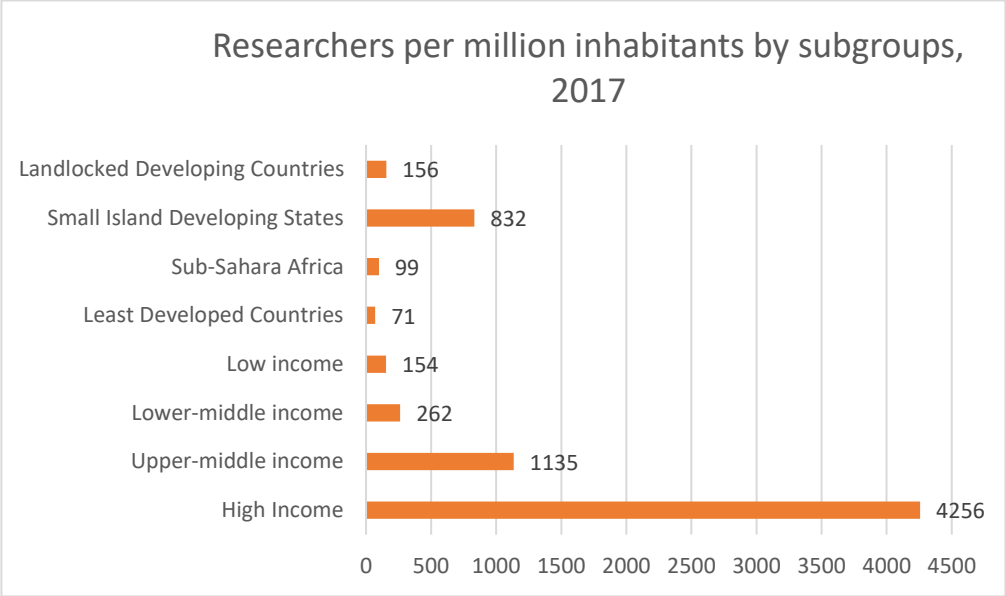
Table 2.3: Readiness towards the use, adoption and adaption of frontier technologies, selected countries

Country name	Total ranking	ICT ranking	Skills ranking	R&D ranking	Industry ranking	Finance ranking
Top 10						
United State of America	1	14	17	2	20	2
Switzerland	2	7	13	13	3	3
United Kingdom	3	17	12	6	11	14
Sweden	4	1	7	16	15	16
Singapore	5	4	9	18	4	18
Netherlands	6	6	10	15	8	23
Korea	7	19	27	3	9	8
Ireland	8	24	6	21	1	87
Germany	9	23	16	5	10	39
Denmark	10	2	4	25	21	5
Selected transition and developing economies						
China	25	99	96	1	7	6
Russian Federation	27	39	28	11	66	45
Brazil	41	73	53	17	42	60
India	43	93	108	4	28	76
South Africa	54	69	84	39	71	13
Source: UNCTAD						

According to UN Report (2021), based on this index, the country's best prepared are United State, Switzerland and the United Kingdom. Other than the United States, Singapore and the

Republic of Korea, most of the leading countries are in Europe. South Africa is ranked number 69 in ICT; however, the aggregate ranking is 54.

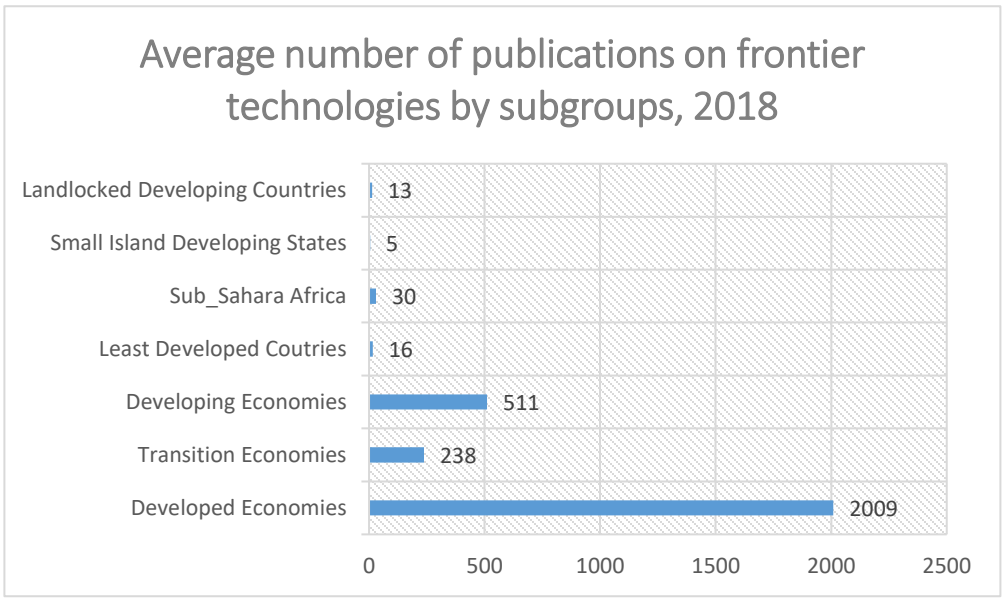
Figure 2.1: Researchers per million inhabitants by subgroups, 2017



Source: UNCTAD based on UNESCO (2020a)

According to UNIDO Report (2021), progress in using frontier technologies can also be measured through the number of relevant science and technology publications. The figure above indicates that the developing countries are behind.

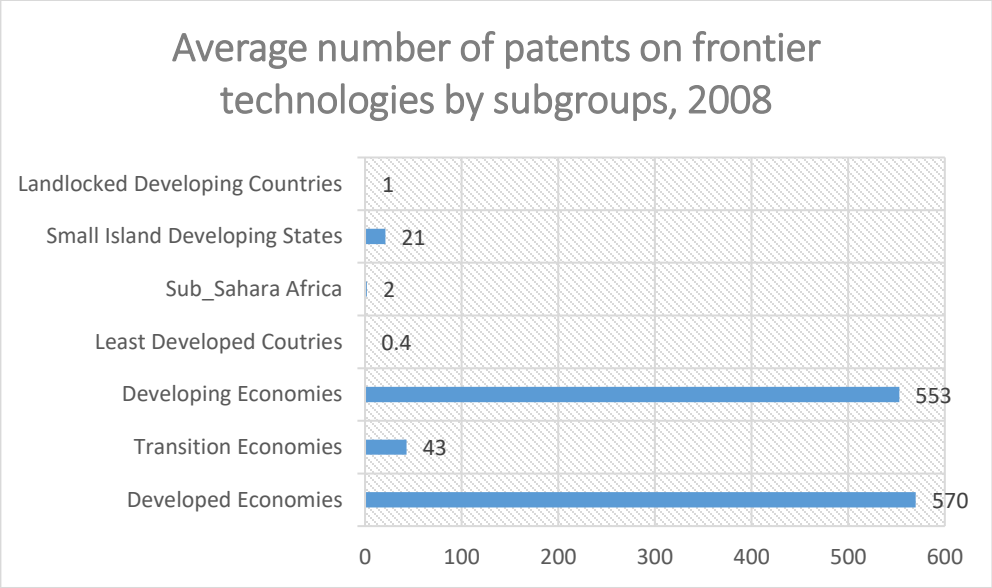
Figure 2.2: Average number of publications on frontier technologies by subgroups, 2018



Source: SCOPUS (cited on UN Report 2021)

Figure 2.2 above indicates that developed countries take the lead in average number of publications on frontier technologies. Sub-Sahara Africa is also not doing well compared to developed, developing and transition economies.

Figure 2.3: Average number of patents on frontier technologies by subgroups, 2018



Source: Patseer (cited on UN Report 2021)

Sub-Sahara Africa also lag behind in terms of average number of patents on frontier technologies. Countries that had more average number of patents are those that are also good in research development and publications. The figure above indicates that developed and developing economies are doing very well the number of patents on frontier technologies.

2. People and Skills

South Africa has a young population and high unemployment and as such requires a 4IR strategy that will look at how we develop people and the skills in the country that addresses those who are neither in employment nor in education (NEETs) as well. The 4IR requires a skilled, capable and technologically advanced workforce, which is continuously learning, and keeping pace with the

rate of development and change that the 4IR makes the norm. A smart and connected society is also fast becoming the norm and South Africa has key issues to solve for in attaining this goal.

The UN Report (2021) revealed the world digital skills for the developed and developing countries as indicated below:

Table 2.4: Gaps in Digital Skills

Population with basic computer skills (%)	
Developing Countries	46
Developed Countries	65
Population with standard computer skills (%)	
Developing Countries	39
Developed Countries	49
Source: UNCTAD based on ITU (2018,2019)	

Table 2.4 above shows that there are fewer people with basic skills in the developing countries compared to the developed countries. This is also the case in terms of the population with standard computer skills. Developed countries had 49% percent of the population with standard computer skills compared to 39% in the developing countries.

3. Infrastructure, Resources, and Natural Environment

There is fundamental infrastructure required as the foundation of 4IR participation for citizens and indeed a country. In the road to a smart world and environment, South Africa needs to look into connected smart cities, towns and communities. Transportation of goods and people can be made more efficient. Importantly sustainable needs to be a focus by leveraging clean renewable self-sustainable energy more while advancing environment and control mechanism.

4. Economic Growth and Inclusivity

The 4IR requires and makes the norm, smart business models and smart money. South Africa needs to understand its structural economic make-up and align with growth opportunities presented by the revolution. Economies of the 4IR are built on intellectual property and are driven predominantly by entrepreneurs. Smart businesses built for this revolution are run by deploying

smart business models, new ways of production, distribution and cashless seamless payments. New economic sectors and opportunities are created through innovation and countries are more finding themselves competing globally where geographical boundaries no longer limit business. South Africa needs to use this opportunity to drive growth in its economy and ensure that is proactively growing and supporting industries that are aligned to the 4IR, while enabling all industries with 4IR capabilities.

5. Stakeholder Relations and Governance

4IR breaks down the segregation of many aspects and requires more of a convergence in things that previously remained separate (e.g.; Cyber and Physical worlds). This reality requires a higher prevalence of interdisciplinary approaches and stakeholder collaborations. In this regard, Smart Government as well as Smart Partners, becomes paramount. In order to support this, there is a need for governance to become increasingly electronic as well as enabling. Smart laws that allow for technological advancement; sound Governance and an accountable Government that is efficient and more and more real time; smart collaboration both continentally and globally on common goal aimed at improving life; all become more and more of the norm.

HUMAN CAPACITY DEVELOPMENT

According to the Presidency Commission Report, Educator Ken Robinson in his book, Creative Schools, states that “Our current education system is a construct of the third industrial revolution. It was developed in response to the demand of a 3IR economic system. The problems of the current education system are not accidental by-products of standardized education; they are a structural feature of these system. They were designed to process people according to particular conceptions of talent and economic need and were bound to produce winners and losers in those terms.

According to the Presidency Commission Report, currently, the South African 4IR Human is ambitious and dreams of a better life. They are, however, excluded from the mainstream economic opportunities and the fact that they do not have knowledge and skills to compete globally makes it harder to find a job, earn an income and make choices that better their lives. One of the most important objectives of South Africa’s 4IR should be to re-integrate the South African 4IR Human into the thrust of the main economic engine.

In terms of Human Capacity Development, the Presidency Commission outlines the following recommendations:

HIGH LEVEL RECOMMENDATIONS (SOLUTION)	ACTIONABLE PROJECTS / POSSIBLE AREAS OF INTERVENTION
Catalyze Structural Change in the Education System We must attempt to initiate changes which are catalytic to structural change, as it is inevitable that the education system will evolve structurally to reflect the architecture of the 4th industrial revolution over time. Thought must be given to flexibility, agility, speed of accreditation, integration of learning streams, mobility of leaners, remote content delivery, cognitive flexibility and the use of technology to enable the efficiency of the skills delivery system.	• Redesign/Alignment of skills ecosystem for agility necessary for 4IR learning • Prioritize the coordination of the various components and systems within the complete skills ecosystem to a new configuration which is fit for purpose for the skills demands of the 4IR era i.e. Stackable competencies which are micro-credentialed, industry aligned and allow people to enter and exit the system at multiple points as part of a lifelong learning process, introducing relevant technology and devices and digital and future skills (competency skills, digital literacy skills). This system change process should be facilitated at the Human Resources Development Council as a priority project for 2020 i.e. have a timeframe associated to the deliverable, assisted by the 4IR Commission and driven by the Digital & Future Skills Forum. Link this ecosystem to cradle to grave nodal network, driven by Al within and across ecosystem components to perform the function of coordination and streamlining. Use the national Digital Skills Strategy as an overarching guideline strategy for skills alignment.

HIGH LEVEL RECOMMENDATIONS (SOLUTION)	ACTIONABLE PROJECTS / POSSIBLE AREAS OF INTERVENTION
Recognize Competency Over Qualification The 4IR economy requires an approach to skills characterized by competencies which are micro-credentialed, industry aligned and allow people to enter and exit the system at multiple points as part of a lifelong learning process. Qualifications become important than competency and skills such as creativity, critical thinking, problem solving are central to skilling in this new era, requiring a focus on both STEM and arts and humanities education simultaneously. Technology enabled platforms can be used to streamline these processes. The need for social scientist will increase as there is a requirement to navigate complex human issues of ethics, wellbeing, identity etc., in this new era of cyber-physical integration as it impacts and shapes our culture. Technical proficiency in relevant digital skills also become paramount.	• Invest in relevant infrastructure – develop minimum infrastructure recommendation for schools for 4IR e.g. DBE must work towards every school having access to internet and no less than 25 computers and a printer, a dedicated room as a maker space for robotics curriculum and a basic set of music and art equipment. • Establish a national project for teacher upskilling in digital literacy, critical thinking and creativity skills. • Provide resources for urgent roll out of ECD learning centres. • Resource the Department of Basic Education with 4IR Strategic Advisory Capacity, a). To drive the implementation of coding and robotics curriculum b). Provide resources for urgent implementation of national roll out of ECD so that 4IR skills can also go to this level • Basic education and Higher Education – within existing curriculum, find ways to teach the skills aligned to the 4IR (critical thinking, solutions, creative thinking) and develop and measure these skills in addition to the content. In this regard use the existing Creative Arts and Life Orientation subjects in the CAPS curriculum. Invest in STEAMIE education.

HIGH LEVEL RECOMMENDATIONS (SOLUTION)	ACTIONABLE PROJECTS / POSSIBLE AREAS OF INTERVENTION
Leverage the youth demographic to establish South Africa as a net exporter of skills in the digital economy	• Innovate and realign the Seta's by creating a framework that guides the scope, budget allocations and priority skills development areas relevant to South Africa's 4IR strategy, including the necessary legislative amendments. • Rethink TVET colleges roles as micro learning institutions providing 4IR relevant competencies. • Adequate resource the South Africa Qualifications Authority to design, test and implement technology solutions for faster turn-around times for accreditation processes. • Consider innovating qualifications assessment criteria to allow for flexible learning pathways and erasing of the boundaries between learning centres and the workplace e.g. broaden definition of unit standards. • Align skills development funding instruments • Intervene in specific areas in Education System .

HIGH LEVEL RECOMMENDATIONS (SOLUTION)	ACTIONABLE PROJECTS / POSSIBLE AREAS OF INTERVENTION
Invest in strategic projects for mass skills development and industry uptake in identified 4IR areas. Initiatives should be scalable for exponential labour market absorption and skills pipeline development. Engage in skills development PPP initiatives across all of the identified high-growth potential industries. A portion of the skills development levy (SDL) can be used for funding the "PBLIC PARTICIPATION" part of the PPP initiative. Establish a cradle-to-grave nodal network, driven by artificial intelligence, within and across sectors. This will enable a skills pipeline linking skills related market demand with an identified talent pool. Skills development courses should be competency based and stackable. This will enable quick turnaround times (as soon as 3 months) in terms of skilling and deployment into industry. In addition, multiple exit streams viz. employment, outsourcing and entrepreneurship is part of the nodal network. This creates flexibility in the system, resulting in opportunity for every individual to realize their full potential.	• Resource and scale the NTIP initiative's model, approach and platform for the manufacturing sector and extend to other industries such as the creative industries, tourism and agriculture. NTIP currently has a working model for the manufacturing sector. The model allows a systemic approach to an industry sector with whole value chain participation which is industry driven. The underlying nodal platform driven by AI provides a coordinating mechanism which makes the system efficient, proactive and comprehensive. Funding should come from the Seta's for these projects. The approach will create a skills pipeline linking skills related market demand with an identified talent pool and can show results within a short period of time without sacrificing depth and quality of skills and human capacity development in a multi-dimensional fashion. • Leverage the Youth Employment Service (YES) programme – link this programme to actual vacancies in emerging industries ▪ include 4IR skills training in the time they are with the sponsor ▪ link the youth to fulltime jobs and vacancies in that entity or other organizations in need of skills. • Establish & resource Creative Industries Hubs and Clusters in townships and rural areas for Digital Content Production including animation, gaming, virtual reality and augmented reality, photography, graphic design, sound production, audio design, film & video production, digital art production, transmedia, digital marketing. Cluster creative industries SMME's in these hubs where a full value chain intervention from skills, to incubation, to content origination, content production and distribution in a networked system is supported, linked to industry. The Gauteng Economic development department is coordinating a process, along with most of the Gauteng metros/municipalities (although it is industry driven) in which industry mentorship and partnership and access to local and African markets is already leveraged. This initiative can be capacitated and scaled with funding from the Seta's as well as PPP arrangements. New foreign owned entrants to our market

	can be engaged with government as a facilitator, to invest in content production infrastructure via BBBEE equity equivalency processes etc. • Maximize the planned Digital Hubs Rollout - The currently budgeted for and planned government roll out of 100+ digital hubs should be leveraged for 4IR skills development, 4IR awareness programmes and social dialogue regarding 4IR in the SA context. The Hubs should be maximized to include the spaces and technology relevant to the full spectrum of digital skills (ICT + digital creative skills), competency skills (creativity, critical thinking, problem solving, collaboration, negotiation etc.) and entrepreneurship skills.

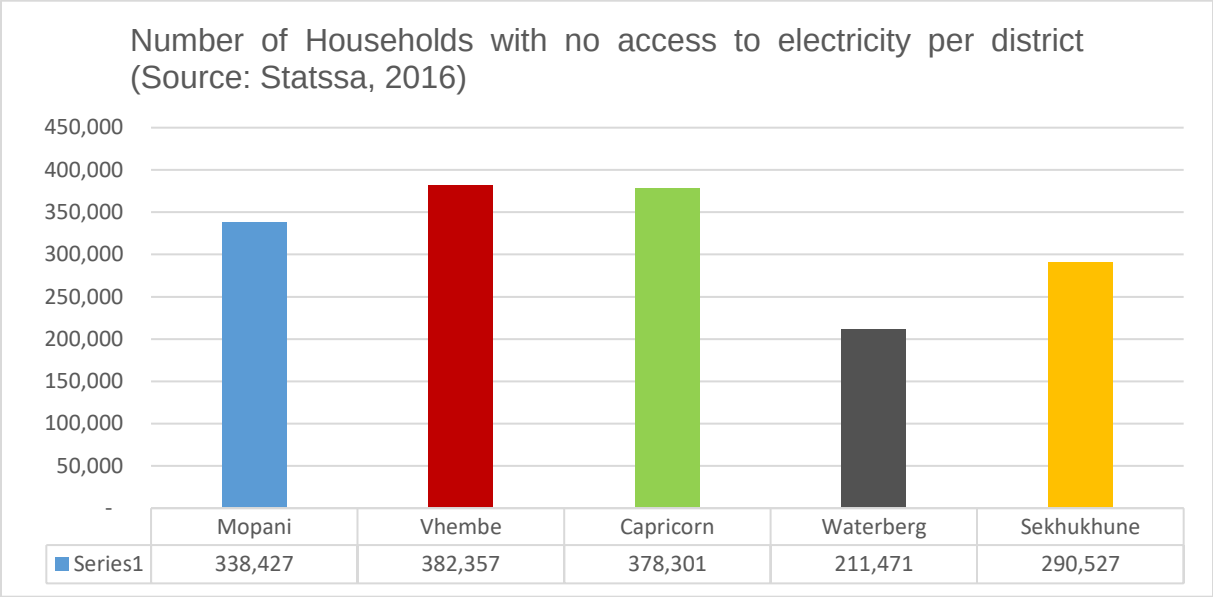
HIGH LEVEL RECOMMENDATIONS (SOLUTION)	**ACTIONABLE PROJECTS / POSSIBLE AREAS OF INTERVENTION**
Social dialogue should be encouraged & stimulated for an inclusive national discussion regarding 4IR and its implications for South Africa **Social Protection systems and processes** must be negotiated and considered with regards to the changing world of work and what this means for both employers and employees.	• A national platform to educate, inform, update on training and other opportunities in the 4IR context should be established. This platform should be an online platform supported by a variety of campaigns in the public domain, events, workshops etc. • Issues such as promoting social dialogue and collective representation of workers and employers, supporting and incentivizing entrepreneurship and harnessing technology for decent work and job creation must be mainstreamed and coordinated in business, labour and entrepreneurship bodies and fora. • Create Social Protection Scheme for Human Capacity in the SMME & Informal Sectors. • Human capacity in our informal economy and SMMEs requires investment in social protection systems as well as financial mechanisms to boost start up and early stage ventures. Enabling SMME's access to appropriate technology will enhance their growth and ability to scale.

HIGH LEVEL RECOMMENDATIONS (SOLUTION)	ACTIONABLE PROJECTS / POSSIBLE AREAS OF INTERVENTION
Identify key policies and legislation which need to be changed and updated to enable and support the skills ecosystem, the changing world of work and emerging high growth sectors for job creation in 4IR society.	• Attract Critical Skills by Amending Prohibitive Legislation (a) Amend section 19(4) of the Immigration Act be amended to specifically reference 4IR related skills. The amendment should better enable highly skilled immigrants to come and apply their trade in South Africa under favourable conditions. The attraction of highly sort-after 4IR skills be assist in accelerating the development of South Africa's knowledge base and industries. These skills must not be restricted to academia but should include entrepreneurs who intend on starting businesses from South Africa. • Amend Labour legislation to accommodate the Gig economy by recognizing Internet project work as legitimate work. This should include incentives for companies to build Gig Economy platforms to leverage South African 4IR skills for global demand. • Copyright & IP protection – The Copyright Amendment bill is currently with the President for signature. While better than the previous version, it is still highly controversial due to a "fair use" clause that has been included which potentially threatens creative content producers' ownership rights, and according to a PWC review of the draft legislation, could lead to inferior content production for academic textbooks and resources – impacting the skills sector significantly. IP protection and ownership is the bedrock of the creative economy so an in depth look at what this bill means in the context of IR and creative economy as an emerging area for the future of work is important.

CHAPTER 3

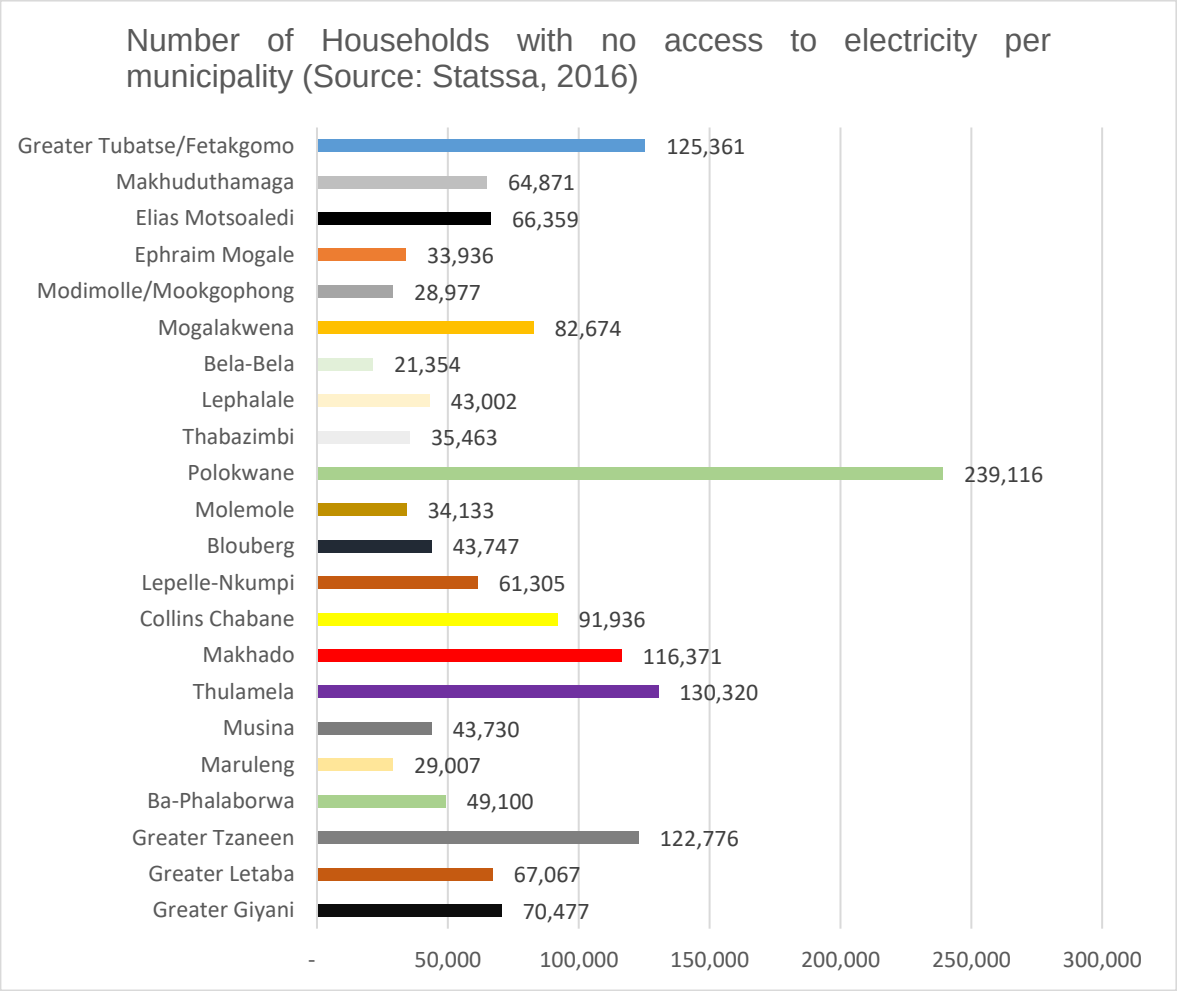
ANALYSIS (RESULTS)

Figure 3.1: Number of Households with no access to electricity per district



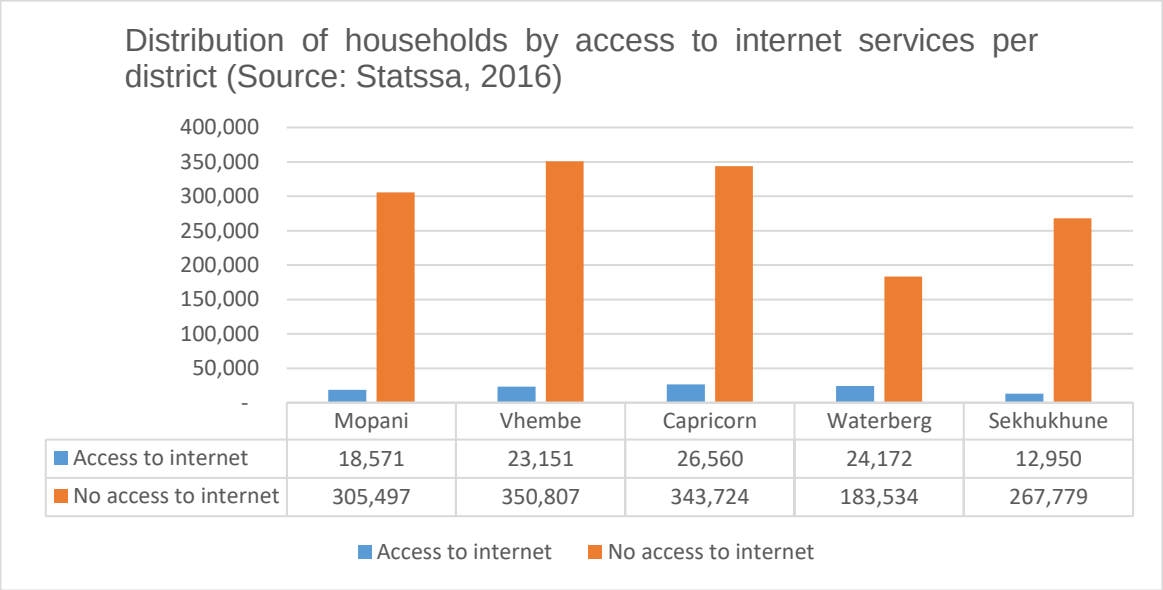
The figure above indicates that Vhembe District municipality had more households without electricity followed by Capricorn District Municipality and Mopani District Municipality. The figure also indicates that Waterberg District Municipality was the only municipality with low number of households without electricity. It is common sense that areas without electricity cannot have knowledge management connectivity.

Figure 3.2: Number of Households with no access to electricity per municipality



The figure above indicates that there are more households without electricity in Polokwane Local Municipality followed by Thulamela Local municipality, Greater Tubatse/Fetakgomo Local Municipality, Greater Tzaneen Local Municipality and Makhado Local Municipality respectively. The figure above also reveals that Bela-Bela Local Municipality had low number of households without electricity followed by Maruleng Local Municipality.

Figure 3.3: Distribution of households by access to internet services per district



The figure above indicates that Vhembe District Municipality, Capricorn District Municipality and Mopani District Municipality were leading in terms of numbers of households which were unable to access internet in 2016. This indicates that there is a positive correlation between low level of electricity connection and low level of internet connectivity.

Figure 3.4: Number of Males who had access & those who did not had access to internet

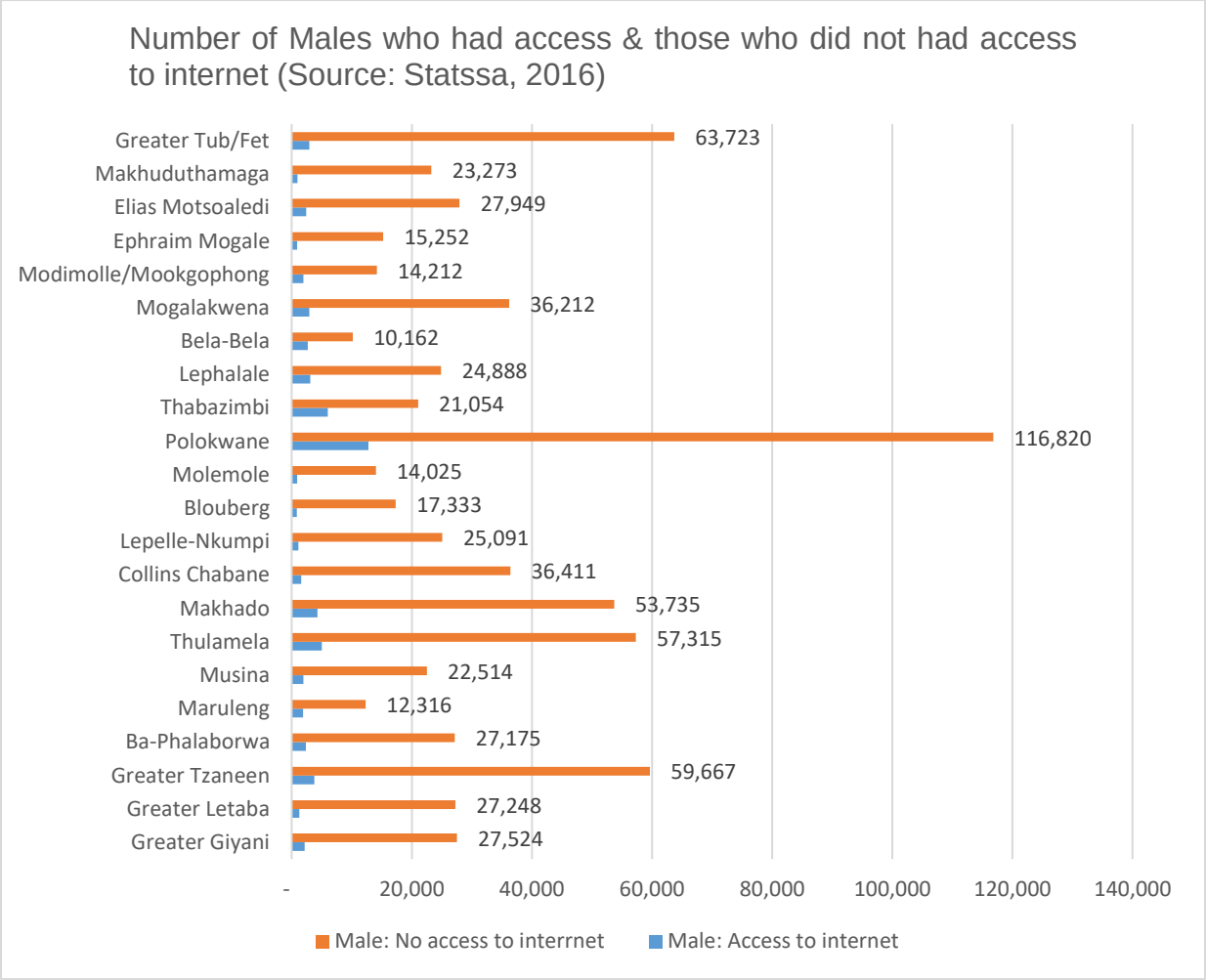


Figure 3.4 above indicates that the number of males with no access to internet in 2016 were more in Polokwane Local Municipality. This might be the case due to the number of people immigrating from rural areas and other countries in search of employment. However, the figure above also indicates that there were male who had access to internet in the same year in Polokwane Municipality compared to other municipalities.

Figure 3.5: Number of Females who had access & those who did not had access of internet

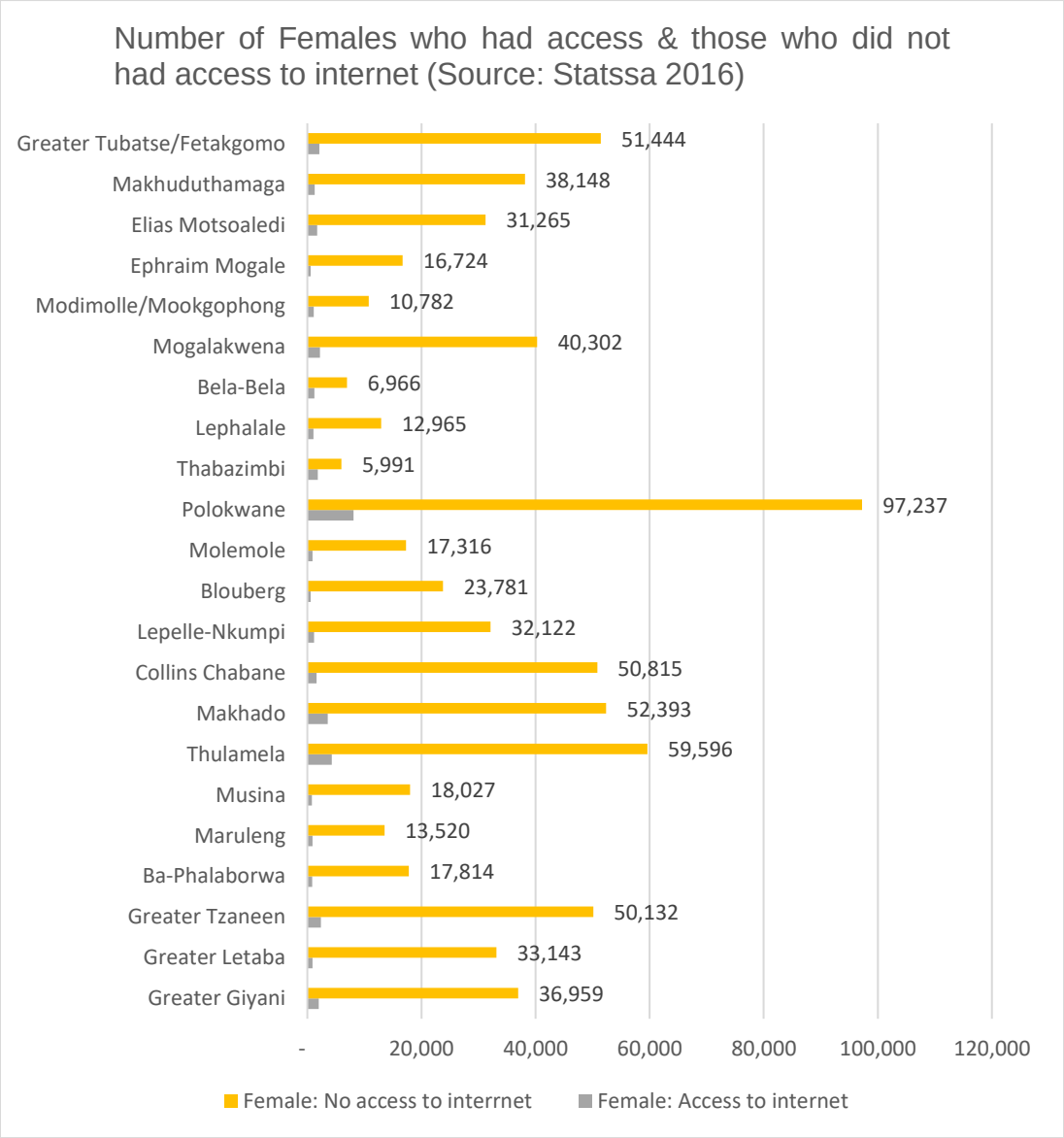


Figure 3.5 above indicates that there were female with no access to internet in Polokwane municipality followed by Thulamela Municipality. The municipality with low number of females with no access to internet in 2016 was Thabazimbi Municipality. This might be that the Thabazimbi Municipality population was lower compared to that of other municipalities.

CHAPTER 4

FINDINGS AND RECOMMENDATIONS

FINDINGS

- Income Poverty – many people in Limpopo Province cannot afford new goods or service, particularly those in rural areas. In this case, the barriers are not necessarily technological but economic and social.
- Digital divide – many areas in Limpopo Province lack adequate digital infrastructure and for most of their people internet costs are prohibitive.
- Shortage of skills – many frontier technologies require at least literacy and numeracy skills. Other technologies require digital skills, including the ability to understand digital media, to find information, and to use these tools to communicate with others.
- Sixty-eight point seventy five (68.75%) of the participants agreed that ICT and SMMEs growth are a priority in this Local Municipality. On the other hand, 31.25% of the participants disagreed with the statement.

- Eighty seven point fifty percent (87.50%) agreed that priorotising ICT and SMMEs would assist the Local Municipality to achieve the 2030 goals, while only 12.5% disagreed with the same statement.

- Ninety three point seventy five percent (93.75%) agreed that SMMEs in some areas in the Municipality do not have ICT tools because of the area in which they are located (e.g., non-availability of infrastructure like electricity and telephone lines, etc.), while only 6.25% disagreed with the statement.

- Eighty seven point fifty percent (87.50%) agreed that most of the areas in the Municipality still have challenges with network connections where even 3G does not work, while only 12.50% disagreed with the statement.

- Ninety three point seventy five percent (93.75%) agreed that the common types of ICTs that SMMEs use are computers, emails, faxes, photocopying machines, telephones and cell phones, while only 6.25% disagreed with the statement.

- Eighty one point twenty five percent (81.25%) agreed that most SMMEs do not have websites and do not use social networks for their businesses except for their personal reasons, while only 18.75% indicated that they disagreed with statement.

- Ninety three point seventy five percent (93.75%) agreed that SMME owners as well as their employees have limited ICT literacy, which makes them unable to integrate ICT into their business processes and strategies, while other SMMEs are challenges are high costs of ICT equipment, while only 6.25% disagreed with the statement.

- Sixty two point fifty percent (62.50%) indicated that they agreed that most SMMEs are not ready to adopt ICT because they have no skills to use it. On the other hand, only 37.50% indicated that they disagreed with the statement.

- Ninety three point seventy five percent (93.75%) agreed that SMMEs entrepreneurs within the Municipality need to be educated trained and supported in the use of the ICT applicable to enhance their business activities in order for them to take advantage of 21st century digital economies present, while only 6.25% disagreed with the statement.
- Ninety three point seventy five percent (93.75%) agreed that Information and Communication Technology (ICT) have the potential to add substantial value to the operations and the competitive position of Small and Medium-sized Enterprises, while only 6.25% disagreed with the statement.
- Ninety three point seventy five percent (93.75%) agreed that SMMEs that are successful often gain strategic positioning with internet, while only 6.25% disagreed with the statement.
- Ninety three point seventy five percent (93.75%) agreed that In order for SMMEs to compete on a much wider scale, the benefits of ICT needs to be taken into

consideration and awareness therefore needs to be raised by the Municipality, LEDET, LEDA, SEDA and all other stakeholders, while only 6.25% disagreed with the statement.

- Sixty-eight point seventy five (68.75%) of the participants agreed that ICT applications are not tailor made to the way SMMEs do business. On the other hand, 31.25% of the participants disagreed with the statement.

RECOMMENDATIONS

- Redesign/Alignment of skills ecosystem for agility necessary for 4IR learning
- The National Department of Basic Education should add ICT skills in the curriculum for both primary and high school leaners;
- Introduce computer literacy programme for educators and make provision of the software required in teaching and learning;
- Invest in relevant infrastructure – develop minimum infrastructure recommendation for schools for 4IR e.g. DBE must work towards every school having access to internet and no less than 25 computers and a printer, a dedicated room as a maker space for robotics curriculum and a basic set of music and art equipment.
- Establish a national project for teacher upskilling in digital literacy, critical thinking and creativity skills.
- Provide resources for urgent roll out of ECD learning centers.
- Resource the Department of Basic Education with 4IR Strategic Advisory Capacity,
- Rethink TVET college's roles as micro learning institutions providing 4IR relevant competencies.
- Resource and scale the NTIP initiative's model, approach and platform for the manufacturing sector and extend to other industries such as the creative industries, tourism and agriculture.
- Establish & resource Creative Industries Hubs and Clusters in townships and rural areas for Digital Content Production including animation, gaming, virtual reality and augmented reality, photography, graphic design, sound production, audio design, film & video production, digital art production, transmedia, digital marketing.

- Enabling SMME’s access to appropriate technology will enhance their growth and ability to scale.

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ACTING DEPUTY DIRECTOR GENERAL **DATE**

ECONOMIC DEVELOPMENT BRANCH

MAJA ML