



SMART CITIES AND THE ROLE OF BANKS: SKILLS IMPLICATIONS FOR THE BANKING SECTOR AND SKILLS DEVELOPMENT

Final report



ACRONYMS AND ABBREVIATIONS

AI	Artificial Intelligence
BANKSETA	Banking Sector Education and Training Authority
CoGTA	Department of Cooperative Governance and Traditional Affairs
DBSA	Development Bank of Southern Africa
DCoG	Department of Cooperative Governance and Traditional Affairs
DFI	Development Finance Institutions
DIB	Dubai Islamic Bank
Fintech	Financial Technology
GDP	Gross Domestic Product
HTFV	Hard to Fill Vacancies
HRD	Human Resource Development
ICT	Information and Communication Technology
IoT	Internet of Things
IT	Information Technology
IUDF	Integrated Urban Development Plan
PSET	Post-School Education and Training
ML	Machine Learning
NDP	National Development Plan
SCF	Smart Cities Framework
SGs	Skills Gaps

TABLE OF CONTENTS

Acronyms and abbreviations	2
1 Introduction	5
1.1 Purpose of the study.....	5
1.2 Scope of study.....	6
1.3 Methodology.....	7
1.4 Structure of report.....	9
2 International trends in relation to smart cities.....	10
2.1 Defining the Smart City.....	10
2.2 Economic contribution of smart cities.....	11
2.3 Global Smart Cities.....	12
2.4 International smart city case studies	13
2.5 Smart cities in Africa	17
2.6 Conclusion.....	20
3 South African policy developments and plans related to smart cities	21
3.1 Policy development.....	21
3.2 Plans for smart cities in SA.....	23
3.3 Conclusion.....	23
4 Banking on smart cities	24
4.1 The role of banks in the establishment of smart cities.....	24
4.2 Can the South African banking sector contribute to the development of smart cities?	27
5 Skills needed in the banking sector for smart city development.....	30
5.1 Skills required from banks for smart city development.....	30
5.2 Do the South African banking sector employees have these skills?	31
5.3 New and emerging occupations	37
5.4 Factors hindering the uptake of Smart City Development	41
6 Education, training and development needed for the sector to function in a smart city context	
43	
6.1 Overview of Education, Training and Development	43
6.2 Education and Training programmes that address the occupations needed in the sector	
46	
6.3 Conclusion.....	51
7 Conclusion.....	52
7.1 Recommendations	52
References	54
Appendix: Employers and employees in the sector.....	57

LIST OF FIGURES

Figure 1: Subsectors in banking	6
Figure 2: Size of banking and alternative banking sector employers	8
Figure 3: Are there new and emerging occupations in the sector?.....	38
Figure 4: Overview of PSET and student enrolment, 2020.....	44
Figure 5: Number of students enrolled in public HEIs by major field of study, 2013-2021.....	44
Figure 6: Number of students graduated in public HEIs by major field of study, 2013-2021	45
Figure 7: Number and proportion of employers per subsector	57
Figure 8: Number of employees, 2022Q1 - 2023Q1	57
Figure 9: Number and proportion of employees per subsector	58
Figure 10: Alternative Banking Institutions Classified by Size	58
Figure 11: Traditional Banking Institutions Classified by Size	59

LIST OF TABLES

Table 1: The major drivers/ opportunities for smart city development in Africa versus the barriers. 17	
Table 2: Current employees with occupations relevant to smart city development	32
Table 3: Occupations relevant to smart city development that are hard to fill	33
Table 4: HTFV, % of employer responses.....	35
Table 5: Skills gaps needed for smart city development	37
Table 6: New and emerging occupations needed for smart city development, % of employer responses.	38
Table 7: Why are there new and emerging occupations in the sector, %of employer responses	39
Table 8: Hindering factors to take up technological advancements, % of employer responses.....	41
Table 9: Information Technology Deployment models used at organisation, % of employer responses	42
Table 10: Number of workers and unemployed registered in SETA-supported learning programmes, 2021/22.....	45
Table 11: Number of workers and unemployed certificated in SETA-supported learning programmes, 2021/22.....	46
Table 12: Education and training programmes on offer, not at all inclusive list.....	46

1 INTRODUCTION

This study commissioned by the Banking Sector Education and Training Authority (BANKSETA) looks at the role of banks in developing smart cities.

Smart cities are emerging in response to how urban populations are increasingly using digital technologies and services for work, rest and play. Convenience and experience are highly valued amongst the new generation of city dwellers. South African cities have adopted the idea of the “smart city” as a vision to work towards. This idea is found in the country’s vision statements and strategic documents and is encouraged by national government.

The smart city concept dates back to the early 1990s when cities began referring to themselves as “smart”. This was after the establishment of Information and Communication Technology (ICT) infrastructure, adopting e-governance, and aiming to draw high-tech businesses to promote economic growth. The origins of the smart city concept have been linked to North American “smart growth” theories of the 1990s – a community-driven reaction to address traffic congestion and air pollution through improved development practices. In 1997, the World Forum on Smart Cities predicted that about 50 000 cities worldwide will start smart city initiatives within a decade. Barcelona, Amsterdam, Chicago, Seoul, Vienna, Shanghai, Shenzhen, Birmingham, Copenhagen, Bangalore and Hong Kong are a few well-known and celebrated examples from the first two decades of the century.

Ten years ago, the number of smart cities worldwide was minimal. Today every nation has a number of smart cities that use modern technology to offer residents an easy and high-quality lifestyle.

Initiatives for smart cities focus on transportation, decreasing carbon emissions and improving energy (and resource) efficiency (Monaghan 2013). Each of these initiatives requires specific focus on the problems faced within the city and the implementation of these solutions are specific to the structures and capabilities within the municipality. In addition, smart city projects require participation from multiple vendors and government agencies. This collaborative approach provides mechanisms for coordinating the work of all these partners and allowing each one to gain value from the project.

The natural consequence of the growth of any industry is job creation, and smart cities are no different. This then leads one to ponder about the skills which are needed in this industry. What skillsets does one require to be able to efficiently manage this industry? Thus, the BANKSETA deemed it necessary to investigate the role of the banking and alternative banking sectors in the establishment of smart cities.

1.1 Purpose of the study

The purpose of the research topic is to provide a detailed analysis of smart cities in both the global and South African context, with the intention of identifying skills in both traditional and alternative banking sectors that will aid in the development of smart cities. In addition, the aim is to investigate the skills the banking sector already has and which additional skills it needs in order to capitalise on the economic opportunities that Smart Cities might generate.

The research questions for this study are:

- What role can the banking sector play in Smart Cities?
- Does the banking sector currently have the skills required to fulfil this role?

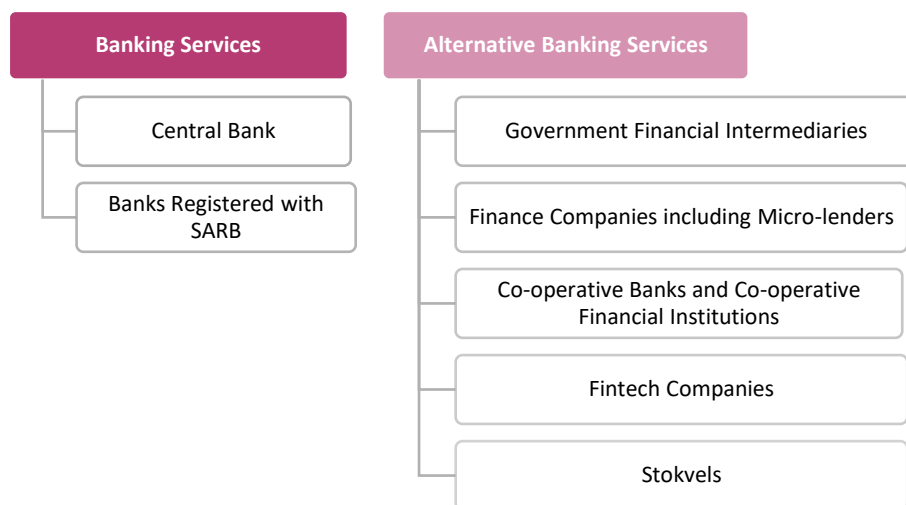
- What training is needed to prepare the banking sector to function within a Smart City context?

1.2 Scope of study

This study covers both the traditional and alternative banking sectors. The banking subsector comprises all banks that are registered with the South African Reserve Bank (SARB) and are in the possession of a banking licence while the alternative banking subsector focuses primarily on lending and savings institutions that are both formal and informal at a micro-level.

The figure below, taken from the BANKSETA SSP (2021) provides more detail:

Figure 1: Subsectors in banking



Source: BANKSETA SSP, 2021

Currently, the South African banking subsector is comprised of:

- 18 registered banks
- 2 mutual banks
- 14 local branches of foreign banks
- 43 foreign banks with approved local representative offices.

The alternative banking subsector comprises:

- over 10 development finance institutions (DFI)
- 4 co-operative banks
- 25 registered co-operative finance institutions (CFI)
- a large number of credit providers, credit bureaus and debt counsellors registered with the National Credit Regulator (NCR)
- over 100 financial technology (Fintech) companies
- over 800 000 stokvels operating throughout South Africa.

The BankSETA employers fall within two typologies: super-large corporate banks that provide employment to almost 96% of the sector and small, medium and micro enterprises. To ensure that all employers irrespective of their sizes are provided with an opportunity to access skills development,

the BANKSETA addresses skills needs of the sector by classifying the sector into the banking and alternative banking subsectors as well as into small, medium and large companies (BANKSETA SSP, 2021).

As reaffirmed by Jivan (2020), the sector includes a number of large and smaller banks. This is in terms of their relative weight of banking assets, retail banking market share and client base. The large 'big-five banks' are Standard Bank, Nedbank, First National Bank (which is part of the First Rand group), ABSA Bank and Capitec Bank. The smaller banks include African Bank, PostBank and UBANK Limited.

1.3 Methodology

The study made use of a mixed methodology by utilising both primary qualitative as well as primary and secondary quantitative research methods. For this study semi-structured interviews were conducted, a survey was administered, and secondary data analysis was conducted. This will be elaborated on below.

The process was as follows:



1.3.1 Literature review

The study started with desk research which was used to develop a literature review. The literature review covered the broad themes below:

- Introduction and definition of key terms.
- International trends – Smart Cities
- South African policy developments and plans related to Smart Cities (including review of the South African Smart Cities Framework (DCoG, 2021)
- The role of the private sector (and banking in particular) in the establishment of Smart Cities
- Review of secondary data from BANKSETA, StatsSA, Quantec etc. – number of employees in the banking sector involved in data analytics.
- Conclusion – with recommendations for refining the primary data collection phase.

1.3.2 Conducting a Survey

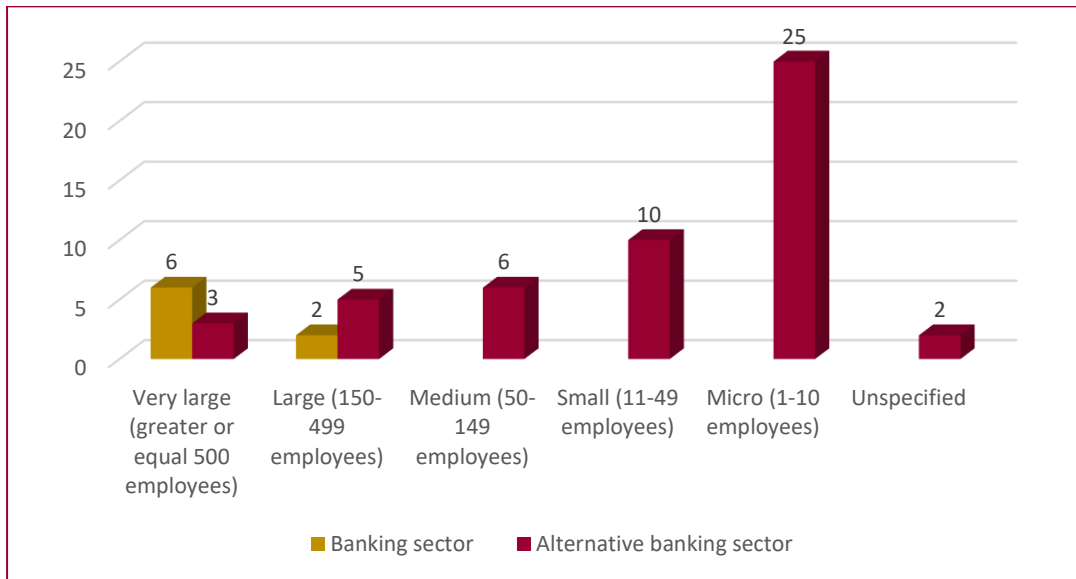
The literature review was used as a basis to develop the survey instruments. Two surveys were developed: one for mainstream banks and one for the alternative banking employers. The purpose of the survey is primarily to gather information relating to banking sector and smart cities.

The survey instruments were developed on the Survey Monkey platform. A list of employers from the BANKSETA database with their contact details was used. Emails and SMSs were sent to all of the

employers on the database, provided the contact details were accurate. There was no sampling technique used. The survey was sent out to 619 alternative banks and 54 traditional banks on the BANKSETA database. Of the 619 alternative banks, 51 responses were received, and of the 54 traditional banks, 8 responses were received. Some employers skipped certain questions and as such, not all employer responses are represented in each question.

The figure below depicts the number of respondents from the banking and alternative banking sectors to the survey.

Figure 2: Size of banking and alternative banking sector employers



Source: BANKSETA survey, 2023

Banking sector employers who responded to the survey are predominantly very large (N=6) and alternative banking sector employers who responded to the survey are small (N=10) and micro (N=25).

1.3.3 Conducting Interviews

The literature review and the survey were used as a basis to develop interview instruments. Semi-structured interviews were conducted with key stakeholders in the sector including employers, training providers, as well as representative bodies in the banking sector. These semi-structured interviews contextualised the quantitative data and provided details on which skills are needed by the banking sector to contribute to the establishment of Smart Cities. These instruments were tried and tested, further developed based on feedback, and approved. The instruments are included in Annexure 1.

A matrix of key informants was developed and agreed with the SETA prior to interviews taking place. An introduction letter was developed to facilitate introductions with the research team and participants.

1.3.3.1 Sampling method

For this study, interviews were conducted with 3 groups of stakeholders: employers, training providers, and associations.

In terms of banking sector employers, the aim was to interview all the locally controlled banks (14 banks). Interview requests were sent to these banks, of which 6 requests were accepted and 6 interviews were conducted. For alternative banking sector employers, 6 organisations were randomly selected covering 2 small, 2 medium and 2 large size employers. Interview requests were sent to which 2 organisations accepted and conducted the interviews. In total, 8 employers were interviewed.

For training providers, 16 organisations on the BANKSETA database were selected and 5 interviews were conducted.

For industry organisations, desk research was conducted to determine which are the key associations representing the sector. From the desk research, 17 organisations were identified, and an attempt was made to interview all. However, only 4 interviews were completed.

The interview sample was intended to be informative rather than representative - we looked for people who could provide insights and explanations. All qualitative interviews were recorded, summarised, and analysed. A thematic analysis was conducted capturing key themes. The findings from the analysis were linked to the research questions.

1.3.4 Consolidation of findings and writing of draft report

The approach and methodology were designed to achieve a level of triangulation: establish what we know from the literature, add and enhance using a survey, and conduct qualitative interviews to verify what is known, fill gaps, explain and explore solutions. In doing so, there is a level of triangulation that enables the research to make findings, draw conclusions and make recommendations.

All the different streams of research, including the literature review, interviews and survey were analysed and used to develop the draft report.

1.3.5 Limitations

A key limitation of this study is the low response rate received from both alternative and traditional banks in the interview and survey processes. For the survey, 619 alternative banks were contacted and only 51 responses were received. Similarly, 54 traditional banks were contacted and only 8 responses were received. A total of 59 survey responses (N=59).

With regards to the interview process, the research team aimed to interview 30 stakeholders in total, however, due to numerous scheduling conflicts and lack of responses, only 17 interviews were conducted. Nonetheless, key findings were drawn from the available responses in terms of the skills and training required to upskill and prepare the banking sector to be able to function effectively within a Smart City.

1.4 Structure of report

The report has 7 Sections. Section 1 introduces the study and discusses the methodology used. Section 2 looks at the international trends in relation to smart cities. Section 3 discusses the South African policies and plans in relation to smart cities. Section 4 discusses the role of banks in the establishment of smart cities. Section 5 looks at the skills needed in the sector for smart city development. Section 6 discusses education, training and development needed for the sector to function in a smart city context. Section 7 concludes the study and provides recommendations.

2 INTERNATIONAL TRENDS IN RELATION TO SMART CITIES

2.1 Defining the Smart City

The phrase "smart city" has been given several definitions by different individuals and organisations. The term "smart city" does not, however, appear to have a universally accepted definition or common understanding. While early definitions of smart cities tended to emphasise the technologies to be used, there seems to be a growing realisation that "smart" technologies should not be prioritised at the expense of issues such as social inclusion and sustainability. Recent definitions of smart cities tend to highlight the need for smart cities to improve people's quality of life. Examples of some international definitions are presented below:

- The United Nations specialised agency for information and communication technologies (ITU) analysed nearly 100 definitions of smart cities to develop the following definition:

"A smart sustainable city is an innovative city that uses information and communication technologies (ICTs) and other means to improve quality of life, efficiency of urban operation and services, and competitiveness, while ensuring that it meets the needs of present and future generations with respect to economic, social and environmental aspects".

- The British Standards Institute (BSI) defines smart cities as follows:

"The effective integration of physical, digital and human systems in the built environment to deliver a sustainable, prosperous and inclusive future for its citizens".

- The Smart Cities Strategic Advisory Group of the International Standards Organization (ISO) formulated the following definition of a smart city:

"A "smart city" is one that increases the pace at which it improves social, economic and environmental sustainability outcomes, responding to challenges such as climate change, rapid population growth and political and economic instability by improving how it engages with society, how it applies collaborative leadership methods, how it works across disciplines and city systems, and how it uses data, information and modern technologies in order to provide better services and quality of life to those in, and involved with, the city, now and for the foreseeable future, without unfair disadvantage to others or degradation of the natural environment".

- According to the website Techopedia, a smart city can be described as follows:

"A smart city is a designation given to a city that incorporates information and communication technologies (ICT) to enhance the quality and performance of urban services such as energy, transportation and utilities in order to reduce resource consumption, wastage and overall costs. The overarching aim of a smart city is to enhance the quality of living for its citizens through smart technology".

- The Urban knowledge Exchange and CSIR described smart city as follows:

"Cities which use technology for the management and monitoring of infrastructure, customers, personnel, finances, and systems within the city. A Smart City enables efficient management of municipal infrastructure, including water, sanitation, roads, stormwater and electricity. These ambitions are enabled through sensors, such as the Internet of Things, providing quantitative data feeds real-time from infrastructure, and integrated management systems within the municipal

environment. It has been argued that enhancing municipal performance will deliver improved services, which align with the Constitutional mandate of delivering basic services to all.”

According to Carshif Talip, expertise leader for Urban Planning and Land Infrastructure at engineering consultants Zutari, a ‘smart city’ is a city that leverages innovation to achieve its desired outcomes. Furthermore, Talip explains that innovation does not necessarily mean only technology: “A smart city is a city where opportunity, amenity, safety, resilience, inclusivity and prosperity are imperatives, and innovation across financing, design, construction, operations and governance is embraced by all stakeholders to achieve these imperatives”.

In sum, there is no commonly acceptable definition of a smart city. The understanding of the smart city concept varies for each city. Each city or country must establish its own definition based on its setting, capacity for new construction, and need for retrofitted projects (Barclays, 2020).

2.2 Economic contribution of smart cities

The cutting-edge technological innovations that make smart cities what they are necessitates significant economic investment on the part of the city, region or country. According to Miller (2022), a smart city relies on advanced technologies, such as the Internet of Things (IoT), 5G, machine learning (ML), and smart cameras. These are the cities of the future, but only if there are enough skilled IT professionals to fill necessary job roles.

A report by Martinidis (2019) highlights 10 economic benefits that comes with a successful implementation of smart city initiatives:

1. **Automation** - brings cost savings, with AI-based and IoT technologies. Automating city resources such as water and electricity, the city ends up saving significant amounts of money. For example, in 2014, the city of Barcelona saved more than 75 million euros just by automating the city’s certain resources such as water, electricity and many other.
2. **Ensuring Proper Efficiency** - smart city sensors are making sure that resources are used without losses, increasing efficiency, and saving money.
3. **Mitigating Risks and Reducing Damages** - in case of a disaster, this is another way in which a smart city can cut down expenses, as well as increase safety.
4. **Quality of Life** - also has economic benefits as happy citizens care more about the city and work to further improve and develop the city.
5. **Connectivity** - the smart city feature of having every device connected to each other, improves the city’s performance and this is strongly connected to its economy.
6. **More Inflow of Talent** - more people will be attracted by the safer, happier environment of the smart city, which will lead to a rise in the GDP and overall economy of the city.
7. **A Sustainable Ecosystem** - reduced emissions and cleaner cities greatly increases the standards of living, happiness and economic growth. For example, the Fujisawa Smart town which consists of 1000 homes in Japan reduced 70% of its carbon emissions just by migrating to solar powered system.
8. **Smart Transportation** - reducing congestion and pollution can have great benefits in terms of money and time saved. According to Dataflog, large cities can save up to \$800 billion per year by implementing smart transportation features and utilising them to reduce congestion.

9. **Smart Buildings** - connected with each other, saving resources, and even generating their own electricity and heating, can help sustainability and add to the economy on a daily basis.
10. **Big Data**- the data is extremely valuable both to city authorities and especially to companies, who find the data very important for commerce, although strict ethical and legal standards have to be maintained with regard to its use.

A 2018 report by McKinsey and Company states that rapid urbanisation is leading to smarter cities that will improve the lives of citizens with the use of technology. Furthermore, the report suggests that the value of the smart city industry is projected to be a \$400 billion market by 2020, with 600 cities around the globe expected to generate 60% of the world's Gross Domestic Products by 2025. Furthermore, a white paper by ABI research which analysed the scope for cost savings and efficiency as a driver for smart city deployments, smart city technologies and IoT, found that it could save enterprises, governments and citizens a total of over \$5 trillion globally per year.

In short, the report by McKinsey and Company (2018) and Martinidis (2019), suggest that smart cities are expected to see 5% annual economic growth, which translates to nearly \$20 trillion in a decade, demonstrating that smart cities are a great investment that can have a positive impact on the economy.

2.3 Global Smart Cities

Smart cities are becoming increasingly prevalent worldwide as they offer residents a more modern and efficient way of living. Building them needs intensive preparation, time and labour, requiring collaboration between different industry leaders, policymakers, governmental organisations, and technology specialists. Smart cities have been (and are being) implemented globally, most notably in Singapore, but also in other prominent cities in India, Denmark, Finland, England and the United States of America.

Early definitions of smart cities premised success on a city's ability to adopt technological solutions. Cities in developing countries, desperate for quick and efficient solutions to their challenges, were sold vendor-led approaches. These often benefitted the smart city technology vendors more than the city residents and broader society. However, globally, smart cities have begun shifting towards human-centric approaches and definitions of a smart city:

- In Spain, the City of Barcelona has built its smart city around participation and citizen involvement.
- In New York City, participatory budgeting processes have included the use of open platforms to involve urban residents in identifying areas and projects for development.
- In Scotland, Glasgow has installed closed-circuit TV cameras to monitor activities in public spaces through an operations centre, in order to improve urban safety.

Robotics will be instrumental in the rise of hyper-connected smart cities (Bowen, 2019). The presence of robotics is even more critical in countries with ageing populations and labour shortages that hinder operational efficiency. Countries have already started using robotics, as listed below:

- Singapore hotels are already using service robots to clean rooms and deliver supplies.
- Tokyo, the 2020 host of the Olympics, introduced robot taxis for flexible transportation for tourists.

- Dubai is already experimenting with the working of robots in public services, transportation, policing and surveillance, as well as targeting automation of 25% of its transportation system by 2030, all as part of its efforts of creating the happiest city in the world.
- Alibaba group holding limited invested \$15 billion into its own robotic logistics infrastructure.

Recently, the idea of smart cities has emerged as a significant urban development and governance narrative on a global scale. Today one-third of United Kingdom cities and two-thirds of United States cities are involved in smart city initiatives. The European Union's programme on Smart Cities and Communities launched in 2014 has, thus far, funded projects in 40 'lighthouse cities' and 50 'fellow cities' (Blake & Odendaal, 2021).

Furthermore, The GIZ programme in India has provided strategic and technical assistance support to the Government of India and it has reaped dividends in its programme with the Smart Mission in India. The GIZ programme has been participatory where government has worked with communities to lower the GHG emissions in local communities. Foster (2020) refers to this as a bottom-up smart city where public participation is improved, and inclusive development drives the programme. Similarly, Ruiters (2020) states that the GIZ, in collaboration with India's Ministry of Housing and Urban Affairs, has partnered to develop India's Climate Smart Cities initiative, which will support the Government of India in the planning and implementation of smart and climate-friendly measures for infrastructure and area-based development, as well as the measuring and monitoring of their GHG emissions. The project started with three Indian Smart Cities of Bhubaneshwar, Coimbatore, Kochi and their respective state governments of Odisha, Tamil Nadu and Kerala and hopes to reach the 100 Smart Cities identified in the Smart Cities Mission project. The Smart Cities Mission is "to drive economic growth and improve the quality of life of people by enabling local area development and harnessing technology, especially technology that leads to Smart outcomes" (Rashmi, 2018). 100 cities have been targeted under this mission covering the period 2015/16 to 2019/20.

2.4 International smart city case studies

The LGSETA (2022) report on exploring the smart city concept and its impact on the local government sector discusses the international development of smart cities. The report looks at a number of case studies including Singapore, Denmark and China. These are discussed below:

2.4.1 Singapore City, Singapore

Singapore, like many other countries and cities around the world, has seen a rapid increase in urban populations in recent years, putting a strain on resources such as housing (Richards, et al., 2020). High urban population challenges, such as pressure on housing, transportation and healthcare, among others, necessitated new thinking about how Singapore city could be run sustainably to ensure citizens receive the best service, thus improving their quality of life. Singapore Prime Minister Lee Hsien Loong announced plans in 2014 to make Singapore the world's first Smart Nation, launching the Smart Nation Programme (LGSETA, 2022).

The Smart Nation Programme was founded on Singapore's desire to distinguish itself as a world-class, tech-driven city-state. The programme is built on three main pillars: digital society, digital economy and digital government. The digital society pillar seeks to ensure that all citizens have access to technology, to improve the country's digital literacy, to assist local communities and businesses in

driving widespread adoption of technology and to design inclusive digital services. “The digital economy pillar focuses on ensuring economic competitiveness through targeted specific interventions in areas of industry and business digitalization, attracting world class talent for innovative ideas and ensuring long-term economic growth” (LGSETA, 2022). The digital government pillar seeks to streamline governance and service delivery by providing innovative, fast and dependable e-services. The report conducted by LGSETA (2022) provided some features for smart city interventions.

The following are some of the key features/ interventions of Singapore’s smart city:

2.4.1.1 Transport and mobility

- Sensor technology used to optimise transport efficiency. Use of autonomous fleets that help the city’s elderly and disabled residents stay mobile.
- Use of self-driving shuttles to ferry students at the National University of Singapore around the campus.
- The use of public data or ‘open data’ in a trial to facilitate transport planning. This data is sourced from fare cards to sensors in more than 5,000 vehicles, and the real-time tracking of busses. A trial of data analysis using these fare cards has reduced the rate of over-crowded buses by 92% (Thales, 2020).
- Implementation of the Travel Smart Programme which aims to more evenly distribute morning peak hour travel demand on the rail network by encouraging citizens to re-think when they travel, how they travel (for instance, switching to bicycles) and the amount of travel (encouraging working remotely).
- Smart transport system through a comprehensive portal that serves all drivers and vehicle owners in the country. This portal is used to access surveillance traffic information, traffic news, travel time calculators, road maps, street directions and parking information.
- Implementation of the Land Transport Authority’s surveillance system checking for traffic incidents. This ensures swift incident detection, which activate vehicle recovery services to tow accident vehicles and clear the roads in record time (Tomás, 2017).
- Use of the Parking Guidance System to provide drivers with real-time information on parking availability. This helps reduce the number of circling vehicles searching for parking spaces, hence saves fuel and the environment.

2.4.1.2 Healthcare

- Interventions to reduce the projected impact of the city’s aging population on healthcare systems using digitalised healthcare (Thales, 2020).
- Use of Telehealth video consultations that offer appointments over the internet when in-person visits are not possible, while Tele Rehab allows patients to undergo exercises in their own home.
- Use of wearable IoT devices monitor patients’ progress and transmit the data to their medical practitioners over a wireless network.
- Use of robotics to help reduce loneliness among the aging population through AI powered ‘chatbots’ that talk to the elderly and tell them about community activities and integrate messages that promote healthy living.

2.4.1.3 Environment

- Innovations on the methods of collecting rainwater to ease water challenges for the city. The public is encouraged to participate in rainwater collection through water efficiency messaging sent by the national water agency (Lee, Hancock, & Hu, 2014).
- Singapore Power provides a mobile application that allows citizens to view their outstanding bills and payment status, gain better understanding of the utility usage and submit meter readings. This leads for consumers to audit their home usage to manage their water consumption.
- Smart waste bins introduced in 2015 have sensing monitors attached on bin lids that collect information on contents and location, with the information notified to a garbage team through a central server. This helps waste collections team to optimise their route planning and at the same time, constantly keep the public spaces clean.
- Constant monitoring of pollution levels and reporting the data on publicly accessible sites. This information includes Pollutant Standards Index (PSI) values and air quality indexes.

2.4.1.4 Energy

- Use of smart sensors embedded household appliances such as lights, which can be automatically turned off when no one is at home.
- Use of smart lighting systems in office buildings that detect motion and adjust automatically.
- Smart meters that are equipped with communication capabilities play a vital role in making the system a two-way channel. They provide both consumers and the grid operator with information on how much electricity they are using.

The use of comprehensive planning, with blueprints for each pillar of the smart nation developed, is one of the key drivers of Singapore's smart nation success. The Digital Government Blueprint, the Digital Economy Framework for Action, and the Digital Readiness Blueprint are among them. This, combined with the ability to move beyond smart project planning and into successful implementation, has resulted in Singapore being named the world's smartest city in the Institute of Management Development's (IMD) inaugural smart city index calculation in 2021. (Low, 2021). Singapore topped the list, which also included Zurich (Switzerland), Oslo (Norway), Taipei (Taiwan), and Copenhagen (Denmark) (Denmark) (LGSETA, 2022).

2.4.2 Copenhagen, Denmark

Copenhagen, Denmark, is one smart city whose central premise is to elevate the role of urban space design and planning for street life and liveability (McLaren & Agyeman, 2016). Copenhagen is the largest city in Denmark, the country's capital and the geographic centre of the Resund Region, with a population of 777 816 people (Statistics Denmark, 2018). According to Jablonska (2018), in recent years, Copenhagen has undergone significant transformation from an industrial city focused on manufacturing to a knowledge, business and technology hub where service and commerce play a significant role in the economy. The Organization for Economic Cooperation and Development (OECD) has named Copenhagen the most liveable city on the European continent and in the world, as well as a world leader in green growth. Copenhagen is a multicultural city, with 25% of the population being of foreign background (Jablonska, 2018).

The city outlines the value of shared public spaces such as Superkilen park for political participation and interculturalism by citizens and residents. In addition, Copenhagen as a smart city highlights the

emergence of modern co-housing as well as exceptional efforts to support cycling with shared cycles, infrastructure and facilities. In its quest to become a carbon neutral capital city by 2025, Copenhagen has been committed to the introduction of innovative solutions within transport, heating, water, waste, and alternative energy sources (Mortensen, et al., 2012). One of the key actions taken towards achieving the carbon neutrality target has been the making of Copenhagen into the world's leading testbed for smart and sustainable energy solution (Jakobsen, 2014). This has been highly instrumental in ensuring the city attracts innovative individuals and companies. The city is also using public-private partnerships to develop new and sustainable neighbourhoods such as Nordhavn, expected to house 40 000 residents and create jobs. According to Lathiya (2017), Copenhagen is one of the leading smart cities in the world because:

- The city has led the Siemens Green City Index for Europe.
- The city is one of the lowest carbon footprints per capita in the world (with less than two tons/capita). The reduction in emissions so far has been achieved mainly due to the increase in the share of renewable energy sources used (Fourtané, 2020).
- All new buildings in the city are to be carbon neutral (referred to as 'green buildings').
- Use of smart street lighting to ensure lights are only on during the times they are needed.
- Approximately 40% of all commutes in the city are conducted by bike.
- Provision of smart bikes with IoT sensors that provide real-time information on air contamination and traffic congestion to the owner and administrators (LGSETA, 2022).

2.4.3 Various cities, China

According to LGSETA (2022) report, China's urban population grew from 22% in 1980 to 57.35% in 2016. This rapid urbanisation has caused issues such as energy scarcity, traffic congestion, social inequality, environmental pollution, land loss, and a lack of public services. These issues stifle city growth and cause them to be disorderly (Shen, Huang, Wong, Liao, & Lou, 2018). To address these issues, a technology driven smart city has been developed. Moreover, Zhu, Li, and Feng (2019) note the main purpose of smart city development lies in innovation towards smart community, smart logistics, smart energy, smart government, smart construction, smart material, and smart medicine.

In China, smart city initiatives are developed through a top-down approach, led and carried out by local governments through their agencies and state-owned enterprises (Yu & Xu, 2018). The Chinese government has made efforts to promote smart governance development through the implementation of policies and regulations such as the National Development and Reform Commission (NDRC) policy for the development of National E-Government. There has been good development at the city level throughout the country, as well as in the villages of the developed regions. Furthermore, Pereira (2013) observes that where smart city programmes were implemented across the country, there was a significant improvement in quality of life and governance efficiency. A city with the performance of a smart economy has an economy which is dominated by the services sector with a higher employment rate in technology and innovation industries. Good smart infrastructure has been the driving force for smart economies in China. As noted by Shen, et al. (2018), Shenzhen city for example has achieved wireless broadband access of 98% of the city's population by June 2017.

According to Shen et al. (2018), of the 44 cities evaluated in China, five cities emerged as good performers by having smart city development plans, financial support programmes, good on-line

services, citizens provided with good access to ICT infrastructure services and citizens provided with various information technology training programmes. However, some constraints have hampered smart city success in China. One of these difficulties is the absence of comprehensive plans and goals. Because smart cities involve many stakeholders such as governments, businesses, and citizens who then integrate resources and technology, there is a need for clear plans and top-level designs for collaboration (Huang et al., 2021). Currently, smart city schemes are provided by technology-oriented enterprises which lack attention in understating local needs. These unclear plans result in smart city construction focusing on some subsystems and not others, thereby causing imbalanced systems. Another challenge is the insufficient environmental protection (LGSETA, 2022). Inclusive, resilient and safe development fosters sustainable urban growth which makes a city competitive. Huang, et al. (2021) note that in China, economic loss caused by environmental problems is 10% of GDP every year which requires smart cities to pay attention to environmental protection in the construction process and consider the sustainability of urban development.

2.5 Smart cities in Africa

The level of urbanisation on the African continent is reflected in the expansion of megacities as well as smaller cities and towns. With over 1.1 billion people expected to live in urban areas across Africa by 2050 (Kanos & Heitzig, 2020), new and smart approaches to city management in areas such as conservation, mobility, governance and economic growth are required (Güneralp, Lwasa, Masundire, & Parnell, 2017). Nonetheless, despite the continent’s growing need for smart cities and urban innovation, there are several barriers impeding the introduction and widespread growth of smart cities across Africa (LGSETA, 2022).

The table below lists the major opportunities for smart city development in Africa versus the barriers.

Table 1: The major drivers/ opportunities for smart city development in Africa versus the barriers.

Drivers of smart city development	Barriers to smart city development
<ul style="list-style-type: none"> • Urban planning • City infrastructure • Sustainability • Mobility • Public safety • Decrease in pollution levels • Improvement in education • Improvement in management and control • Transparency in governance • Improvement in health care systems • Security enhancement • Improvement in quality of housing • Energy efficiency • Home automation 	<ul style="list-style-type: none"> • Political instability • Poor cooperation and coordination between government entities • Political obligation • High urbanisation • Poor public-private participation • Lack of trust between citizens and governments • Poor basic infrastructure • Poor/ insufficient legislations and regulations • Poor basic infrastructure • Poverty • Economic instability • Lack of global competitiveness • Unclear vision for ICT model • Deficit of ICT infrastructure and reach as well as ICT skills • Poor data availability and scalability

Drivers of smart city development	Barriers to smart city development
	<ul style="list-style-type: none"> • High economic inequality • Lack of citizen involvement • Resource and environmental degradation • Poor service delivery • Issues with data privacy and security • Cultural challenges • Low levels of community awareness'

Source: Adapted from Kolandaisami (2020:27-33)

Despite the numerous obstacles identified as hindering African smart city development, existing drivers and opportunities have opened up the continent for smart projects. Based on the six common components of smart cities around the world, it is difficult to identify any specific African city as a truly smart city. However, a number of distinct 'smart' features can be recognised in various African cities by reviewing the processes, policies and features introduced in areas such as ICT literacy, internet reach, transparent governance and medical advancements (Ramoroka, 2020; Das & Emuze, 2014).

The LGSETA (2022) report identified four African case studies, which are presented below:

2.5.1 Kigali, Rwanda

Kigali, the Rwandan capital, has been recognised as one of the top cities to approximate major smart features due to its push for modernisation as part of a wider effort by the Rwanda government to increase and simplify access to public services (Siba & Sow, 2017).

In terms of smart infrastructure, “the city has installed sensors throughout the city to measure air quality, monitor the safety of the power grid and detect water leaks. These measures are critical for ensuring energy and water efficiency, as well as early detection of pollution rises. Kigali has formed collaborative projects with renowned universities in education to ensure that talent from across the continent has a place to meet, learn and grow” (LGSETA,2022). This, coupled with technology advancement and investment, have helped create new jobs for the city’s youth (Pelikh, 2020), making the Rwandan country one of the fastest growing economies in the world. Kigali has become a great example of how the many possibilities of the IoT offer solutions to urban problems and can be used to encourage growth and improve quality of life (Baffoe, Ahmad, & Bhandari, 2020; Pelikh, 2020). However, Rwanda’s smart city rollout in Kigali has had its own challenges, showing that smart city projects still face barriers in implementation on the continent.

While the city rolled out buses with free Wi-Fi and cashless payments in 2016, these buses reportedly had connectivity issues due to the inability of the Korea-built technology to adapt to local conditions (Siba & Sow, 2017). Furthermore, the Kigali smart city has been chastised for failing to include Rwandans of various socio-economic backgrounds. Vision City, Kigali’s Smart Neighbourhood project, aims to create a technologically advanced neighbourhood complete with solar-powered streetlamps and free Wi-Fi in the town square. However, it has been suggested that the project may have overlooked the socio-economic realities of a city where 80% of the population lives in slums and earns less than US\$240 per month (while a home in Vision City costs US\$160 000).

2.5.2 Kenya

Konza in Kenya promises to be an exemplary smart city project built from the ground up with a National Data Centre that provides everything digital a city needs (LGSETA, 2022). The Kenyan government conceptualised Konza in 2008 as part of the government's Vision 2030, which promises significant job creation and economic growth (Burbano, 2021). Konza is expected to collect data from smart devices and sensors embedded in roads, buildings and other assets as a smart city. This data will be shared via a smart communications system, allowing Konza's population to receive valuable information and digitally enhanced services (Konza Techtropolis Project, n.d.). Meanwhile, Wi-Fi points strategically installed all over the city as well as basic internet reach inside homes will ensure that people are connected with each other and the Internet of Things (Pelikh, 2020).

While the Konza project was expected to ignite a trend across the continent, with tech cities sprouting elsewhere and ushering in an information age, this has not yet occurred. Thirteen years later, very little progress has been made on the city, and the entire project appears to have come to a halt (Baraka, 2021). According to Burbano (2021), the project's stagnation could be attributed to a variety of challenges and factors. For example, long delays in project start-up have resulted from inefficiencies in public-private partnership planning. An acquisition process introduced by the National Land Commission (NLC) to allow private investors to purchase land in the city was found to be too tedious, hence delaying any funding progress. The project has also been criticised for failure to benefit from existing country infrastructure as a leverage for growth, while others have noted that the 60km distance from the capital, Nairobi, makes Konza unattractive to professionals (Barbano, 2021; Baraka, 2021).

2.5.3 Zambia

In Zambia, the government launched the SMART Zambia agenda in 2015, which resulted in the establishment of the E-Government Division within the President's Office (Mtonga, 2019). This initiative launched actions aimed primarily at researching opportunities and challenges, lessons learned and exploring opportunities for smart city development in the country. Since then, some progress has been made towards the implementation of smart solutions in specific cases, rather than the construction of full-fledged smart cities. To begin with, "the SMART Zambia transformational programme involved the implementation of an electronic platform that was aimed at improving public service delivery to achieve socio-economic development. In addition, an E-division was created to focus on various areas of smart city development. These include ensuring a standardised approach to the usage of ICTs across all government departments, a coordinated approach to implementation of ICTs and enhancing the efficiency in service delivery. Additional specific smart projects that have been conceptualised in the country include electronic billing and revenue collection, intelligent mobility systems, electronic health systems, and communication platforms and data portal websites. However, none of these initiatives have been fully implemented yet" (LGSETA, 2022).

In addition to smart city initiatives, Zambia also has proposed smart cities such as the Kalulushi mini-smart City Project. This project, developed by the Kalulushi Municipal Council in collaboration with Smart City Limited, will span 67 hectares and will include a mall, healthcare and hospitality facility, office building, golf course, petrol station, adventure, and 200 residential houses. The project's construction recently began in 2021, with a total estimated cost of US\$ 550M in private funds.

2.5.4 Namibia

According to the LGSETA (2022) report, in Namibia, progress in smart city development has also been slow. Oksman and Raunio (2018) discovered in their empirical study of Namibia's readiness for smart city development that, while the SADC region is long overdue for smart initiatives, more needs to be done in the areas of transparent governance and citizen participation. Windhoek's plans to transform the city into a smart city by 2022 were delayed due to a lack of funding. The Tsumeb Smart City project was launched in 2018 to be constructed at the cost of N\$ 20 billion. The project is proposed to include a medical university that will provide an international standard education for approximately 25 000 students, providing them and all staff with accommodation, topped with a modern 800-bed hospital. Six hotels, office parks, residential apartments, entertainment and recreational facilities are also proposed for the smart city. However, two years after construction was supposed to begin, there has reportedly been very little progress in the project (Simasiku, 2020). While there has been little information on the reasons for project stagnation, it has been suggested that funding and red tape issues in licencing have likely contributed to the delay (Simasiku, 2020).

2.6 Conclusion

The common theme in the international case studies are the lengths to which governments have gone to address environmental sustainability, mobility, healthcare and other critical issues. Smart cities across the world were also found to be associated with higher incomes, greater living standards, and increasing energy efficiency.

By examining the various smart city projects, proposals and opportunities in Africa, it is clear that smart projects must be introduced in the context of specific African challenges and issues. For example, given the scarcity of skilled ICT talent required for smart city implementation, consideration must be given to first attracting such talent. Furthermore, the context of inequality must be considered to ensure that smart city development does not result in the disenfranchisement of the poor in the respective cities. It is also evident that there are over-arching themes in the development of smart cities, with funding, governance and transparency issues appearing more on the proposed projects. More work will be required in the areas of governance, establishing trust between governments and citizens, and streamlining legislation to facilitate private citizen/investor participation.

3 SOUTH AFRICAN POLICY DEVELOPMENTS AND PLANS RELATED TO SMART CITIES

Globally, smart cities are seen as catalysts for sustainable growth. Due to the projected growth in urbanisation over the ensuing decades, smart cities are particularly important to Africa. The rapid urbanisation over the years is projected to continue to increase with approximately 70% of the world living in cities (Crous, Palmer, Griffioen: 2017). The findings by Palmer et, al (2017) suggest that African cities are resilient, able to accommodate and manage the population influx. Smart cities will also potentially create enabling environments for towns and rural areas, which are expected to be a part of African countries for the foreseeable future. This chapter examines how South Africa has adopted the smart city in policy and practice.

3.1 Policy development

The National Development Plan (NDP) identified South Africa as a developmental state that should ensure the economic and social well-being of the country and its people. The developmental state would ensure safe and affordable transport and sufficient energy for industrial growth. CoGTA has since finalized a National Smart City Framework that would guide the development of smart cities in South Africa. This South African Smart Cities Framework (SCF) was developed by the Department of Cooperative Governance (DCoG) to provide municipalities, national and provincial government, the private sector, civil society and other role players with impartial, factual information about smart cities in South Africa. The SCF supports DCoG in its efforts to guide and coordinate smart city initiatives planned and implemented throughout the country (DCoG, 2021).

The purpose of the Smart City Framework is to guide decision-making and provide all role players with a structured approach to identifying, planning, and implementing smart city initiatives that are appropriate to the local context (CoGTA, 2021). The novel feature of this framework in comparison to existing literature on smart cities, is that of a clearly delineated division of labour between the various spheres of government. The framework defines the role of government as responsible for the provision of the following:

- Supportive Political Environment
- High-Level Infrastructure
- National Priorities and Standards
- Legislation and Regulation
- Procurement Processes
- Targeted Funding

The main risks from the framework are that:

- i. it does not designate government as the leader.
- ii. municipalities lack the requisite capability to implement the framework.
- iii. connectivity is one of the biggest challenges in the country (DBSA, 2021).

In relation to urban development, CoGTA introduced the Integrated Urban Development Plan (IUDF) transformative vision to:

- Ensure people have access to social and economic services, opportunities and choices.

- Harness urban dynamism for inclusive, sustainable economic growth and development.
- Enhance the capacity of the state and its citizens to work together to achieve social integration; and
- Forge new spatial forms in settlement, transport, social and economic areas.

According to the DBSA (2021) currently, there is no single definition of what a South African smart city should be. Due to the lack of a definition, metropolitan cities have developed their own definitions of "smartness". The City of Cape Town focused on the development of a Digital City Strategy to drive the use of technology to make the provincial government responsive to citizens' needs and to ensure that all residents have free access to basic information and communication technologies.

The eThekweni Municipality's Smart City initiatives include energy, transport, ICT and learning in their approach to developing a smart city. Through technology and the Smart Community Initiative, the Metro has connected customers via a smartphone application to local government. Customers use technology to report problems, get revenue balances and receive municipal alerts as part of a programme to improve local government services and increase its accessibility to its citizens (Edge, 2015). The eThekweni Transport Authority (ETA) has sought smart solutions for the transport sector in the municipality. Using a GIS based tool that collates information on road accidents, traffic signal faults, schools and street lighting, the municipality is able to generate information and strategies on streamlining transport services (Aucamp et al, 2016). The metro's energy utility, eThekweni Electricity, has enhanced service delivery, electricity management and user communication by implementing the smart grid concept to the management of electricity resources (Hunsley et al, 2014).

According to DCoG (2021), for a smart South African city to be inclusive, it should adhere to six interdependent principles. These principles provide guidance when decisions have to be made regarding the identification, planning and implementation of smart initiatives and technologies.

The decisions regarding the nature and purpose of a smart initiative or technology should be guided by the following principles:

- It should be smart for all.
- It should use technology as an enabler rather than a driver.
- It should be shaped by, and respond to, the local context.
- It should be informed by the real needs of the community.
- It should embrace innovation, partnerships and collaboration.
- It should be sustainable, resilient and safe.

The metropolitan municipalities of eThekweni and the City of Johannesburg have introduced smartphone applications to narrow the gap between themselves as service providers and their consumers. Social inclusion is a role that DFIs have left to local government and social networks. This role has however become more important with the SDGs and the need to create inclusive sustainable development.

A smart city should benefit all those residing in the city, not only those with sufficient financial and other resources. Thus, CoGTA and the World Bank collaborated to develop a National Smart City Initiative for South Africa that will be implemented in the five big metropolitans (Cape Town, Johannesburg, Tshwane, Ekurhuleni and eThekweni). The initiative aims to provide better, streamlined

and efficient services to citizens. The initiative would define a smart city at a localised level to meet the demands of the citizens and the needs of the city itself (Ruiters, 2020).

3.2 Plans for smart cities in SA

Many municipalities in Africa are experiencing challenges when it gets to the management of infrastructure. In South Africa, smart cities are viewed as facilitators for sustainable development. Moreover, the Constitution of the Republic of South Africa requires that basic services are prioritised, as everyone has the right to basic services. President Cyril Ramaphosa in his February 2021 State of the Nation address announced that several new post-apartheid cities are being conceptualised across the country. President Cyril Ramaphosa said there are three planned smart cities currently in the works for South Africa which meet the criteria (CSIR, 2020). These include:

3.2.1 Lanseria

The aim of Lanseria smart city development is to create the first post-apartheid city in South Africa based on 'best practice' in urban sustainability and the principles underpinning the smart city. "It is to be inclusive of the broadly defined South African socio-economic spectrum and must stimulate a vibrant, mixed urban economy," the masterplan states.

3.2.2 Durban Aerotropolis

The Durban Aerotropolis aims to become a premier business and trade hub in Sub-Saharan Africa. "The plan will turn the entire surface area around King Shaka International Airport into a smart city with diversified economic activities that will boost the province's economy".

3.2.3 Mooikloof mega-city

Officially launched by President Ramaphosa in October 2020, the Mooikloof Mega-City development is set to be built in the east of Pretoria. "Once completed, the Mooikloof Mega-City may end up becoming the world's largest sectional property development, with land also earmarked for schools, shops and offices," he said.

3.3 Conclusion

South African policy developments and plans related to smart cities are put in place to ensure that all citizens residing in the city benefit. This implies that before developing smart cities, all critical unaddressed needs, such as basic services, must be addressed. The three planned smart cities announced by the President of South Africa in his SONA address, does not provide sufficient information on how the city will leverage technology and ICT. Moreover, the socioeconomic challenges of South Africa with State Owned Enterprises (SOEs), high unemployment rates, high poverty, and huge developmental debts make it challenging to implement projects of this scale.

4 BANKING ON SMART CITIES

Banking is the backbone of the modern monetary system. As cities become smarter, there is a huge opportunity for financial systems to be integrated. Residents will be issued smart cards, and all their financial transactions may be integrated with those cards. This will assist the government in collecting all the data required to monitor municipal financial obligations and credit history, while residents will benefit from a single card for a variety of tasks (Miller, 2022). Similarly, mobile phones will also play an important role in smart cities. With the introduction of mobile payments and mobile wallets, these phones have evolved into much more than just communication devices. These applications will provide residents with the freedom to move and pay while also providing the security of not having to carry large amounts of cash.

Bankers' contributions to the development and actualisation of these progressive cities cannot be overlooked. Financial integration is critical for a city's modern-day infrastructure and that is where the banking sector with its cutting-edge technology plays a pivotal part in immersing the residents into the smart city experience.

4.1 The role of banks in the establishment of smart cities

Some of the ways banks can advance the development of smart cities include the following:

4.1.1 Support the public sector with digital capabilities

One aspect of how banks can help a smart city develop, is for banks to use their own digital capabilities to support the smart city ambitions of a city's political leaders and public servants. Banks need to fuse digital and physical assets to make customers' lives easier and more engaged as is presented by Commonwealth Bank of Australia (CBA). CBA, in collaboration with Domain.com.au, provided an exciting home-buying experience for its client: an app that combines advisory service, mortgage application online and a rapid online decision process, as well as e-alerts that keep customers updated on the status of their application (Shmeleva, Makarchenko & Nerkararian, 2016).

Another example is the transfer of funds to the vendor and mortgage balance management that is available through mobile, online and ATM channel. According to Shmeleva et al, (2016), Hana Bank in South Korea provides a full-service bank in a smartphone, the Hana N mobile platform, which combines an integrated money management and monitoring system that works entirely online, NFC payments technology in various stores, location-based offers, and the ability to borrow for larger purchases while in the store. These solutions require cooperation of IT, marketing, product groups, along with the CEO's sponsorship.

Also, the BNP Paribas is one of several banks discussing how a bank could lend its local transaction data analytics and insights to help city planners plan and run services through its research arm.

A sector stakeholder agrees that a smart city model will expand their client base and product offerings - "A smart city model allows for better understanding of clients' needs and increasing proactive offerings. This technology-driven approach allows for a broader client base, enabling financial services providers to develop their country, economy, and create employment opportunities. This ultimately leads to growth and sustainability in the financial services industry" (Stakeholder interview, 2023).

4.1.2 Re-design the bank branch

Literature suggest that banks need to respond to the smart city citizen in the urban space. Banks need to re-design the bank branch in terms of convenience and experience. A true omnichannel approach that integrates a branch visit with a customer's other digital channels is required. This is manifested by next generation bank branches that have digital self-service banking hubs, full-service flagship stores that incorporate digital technologies and should replace traditional branches. According to Auriga (2018), in Europe banks have started to deliver an experiential edge in their urban physical locations. European banks are transforming their urban branches into community and business centres. Some, like Halifax's new central London branch, are making bold statements about how a bank branch should blend together digital self-service and access to expert personal consultation with dedicated, welcoming areas for chat, coffee, food, travel advice and events. What's common to these new branch designs is a digital hub that allows any banking transaction service to be done 24/7 and directly by a customer.

Shmeleva et al (2016) suggest that "Banks might have to consider cutting the number of branch tellers in favour of relationship adviser roles. As technology develops, smart ATMs, in-branch tablets, video teller machines could potentially replace tellers". In Zurich, Raiffeisen's flagship branch, offers a robotic retrieval system for a 24h access to safe-deposit boxes, while Intesa Sanpalo have launched Superflash branches across Italy targeting customers aged 18 to 35, and rather than a bank it looks like a lounge café that hosts special events and attracts a young public with its contemporary design, a spacious self-service area, large tables with video terminal for financial consultations, video walls, instead of posters, offering documentaries and advertising.

State Bank of India (SBI) has launched two types of branches: In Touch and In Touch Lite: where a visitors can open an account using machines and get a personalized debit card (with your name and photograph on it) in under 12 minutes. Together with this service, a client can find a "gamification" table to plan his/her investments and expenses, a "dream wall" for instant loans approval as well as a remote advisor through video conferencing. Furthermore, the Dubai Islamic Bank (DIB) also took the initiative in line with Dubai smart city and modernized its structure and processes. The features include paperless banking, mobile banking and integration with Dubai smart government.

A banking subsector stakeholder stated that their organisation and others in the sector constantly need to raise the bar and keep abreast of the changes in the sector including digitisation. Their bank strives to be a platform business, as opposed to being "only a bank". They are transforming from being a purely financial organisation to "like an online mall to connect both clients, providers, transportation providers, everything that you would need in one place.... So, it is not only when you are looking for finance that you access our platform, but you will be able to connect and collaborate and find your needs depending on what they are, whether it be energy, alternative energy sources, other clients, cheaper ways of transport, whatever the case may be...So, "connecting vendors, connecting customers, connecting intermediaries, connecting consultants and making obviously the underlying finance for all of these functions available" (Stakeholder interview, 2023).

Another stakeholder supported this by stating that the sector is moving towards more platform-based banking and a drive towards digital transformation. Partly to improve operational efficiency – "cost-to-income, reducing cost, finding more efficient ways to do things" but also to improve the customer experience (Stakeholder interview, 2023).

An increasing number of financial institutions are moving towards digital banking. There are also fully digital banks providing a branchless service. These banks need to keep their systems updated and stay abreast of the latest technologies and they rely quite heavily on actuarial and data science skills (Stakeholder interview, 2023).

Furthermore, a stakeholder in the sector stated that the sector is moving towards an ecosystems approach. In terms of this approach, “we are creating ecosystems where a client can go from opening up a bank account, getting an educational loan, through the different phases of their life, to be able to get retirement funding, life cover, educational benefits, short term insurance, health. It really is across how you manage your investments, and it is kind of that ecosystems forcing us to be able to as a company to be competitive across industries” (Stakeholder interview, 2023).

4.1.3 Support mobility with self-service

A new generation of self-service devices can be used to expand a bank’s role in a smart city. Many smart city projects aim to improve mobility, and an ATM could be customised to support those additional digital services by accepting payments or loading a virtual wallet to pay for transportation. An article by the Auriga (2018) suggests that these devices with their inherent security features, could be used to manage shared economy transactions such as car rental or taxi rides. Historically, banks have played an important role in the development of cities. Banks can play an important role in tomorrow’s smart cities by combining digital and branch transformation plans. Thus, one of the interviewees stated that: “Traditional banks face significant opportunities in the emerging technologies sector, as they will need to adopt and harness emerging technologies to improve service delivery and expand their client base” (Stakeholder interview, 2023).

As stated above, some banks are completely digital, providing a branchless service through an online application: “basically a branch in the palm of your hand” (Stakeholder interview, 2023).

In a competitive and changing environment, banking and alternative banking sector businesses recognise that ICT is a resource used to interact with clients. These organisations and their clients have become more communicative and flexible, partly because of new technology. In addition to lowering costs, “ICT helps improve quality through the provision of real-time operations, constant updating of customer information, reduced delays, increased reliability of outputs and standardisation of decision-making” (Cabrita & Bontis, 2008). In an interview, a stakeholder stated that the sector is moving into the platform-based space and undergoing technological transformation to understand customer dynamics and enhance the customer experience. According to the stakeholder, “AI has been a big shift in terms of banking because of its ability to take big datasets and in real time, using machine learning and an even robotic process automation, thereby really making it a lot easier to add value to the customer experience” (Stakeholder interview, 2023).

Understanding customer needs in the smart city environment is key. And financial institutions need to interpret customer behaviour, understand what their wants and needs are and be able to design transactions or solutions or services that makes sense to customers. These services are tailored to individuals instead of generalisable. As a stakeholder put it “We see the needs and wants of our clients and are able to make sure that our services meet those expectations no matter how it evolves... information around where people prefer to shop. Do people prefer to travel 10 kilometres or 5 kilometres to get to the shopping mall? That information can be really valuable” (Stakeholder interview, 2023). This type of transaction data, amongst others, banks have access to.

According to Imarticus (2021), Fintech has already facilitated the banking structure by providing personalised banking services to customers. These services are customised and can be changed at any time. In addition, various Fintech corporations, in collaboration with banks, operate many online banking facilities and ATMs. These services include smart market, public payments and deliveries and rental taxi services.

4.1.4 Promoting a sustainable environment

Complying with environmentally sustainable development goals has become increasingly important in the sector. Mihov, Goulven and Stabile (2022) state that most institutional investors (88%) scrutinise a potential investment's commitment to Environmental, Social and Corporate Governance (ESG) as much as they scrutinise the investment in terms of financial and operational practices. Stakeholders state that their organisations fund things that are not going to be destructive in terms of the environment – “promoting sustainable finance...they could be funding energy efficient buildings or energy efficient installations, for example” (Stakeholder interview, 20230).

4.2 Can the South African banking sector contribute to the development of smart cities?

Smart cities depend heavily on financial integration, and the banking industry, with its cutting-edge technology, is crucial in bringing the smart city experience to citizens.

Stakeholders in the sector maintain that financial institutions play a critical role in the establishment and support of smart cities. The positive contribution of financial institutions to smart city development is highlighted in interviews with stakeholders, as demonstrated in some of the quotes below:

Stakeholder 1: "Yes, absolutely. So, if you look at what banks they are very good at making project finance available. So firstly, project funding for a smart city, which is something that the banks can provide, and they are very good at making sure it is done in the correct way. And the right kind of funding is made available to develop the various components of a smart city. Also, banks are very good at making available the digital payment infrastructure to implement digital payment systems in the smart city as you can think a smart city by definition, will be a very high-tech environment. Everything will be digital, and the banks are extremely well positioned to make that available to the smart cities. So that payments can be made and received digitally across the entire city. Banks have also become very good at data analytics. If you look at big data and analysis, and banks are very good at gathering a large amount of data, and the outcome of this information that they have on this data can be shared with the city planners and developers to make sure they understand exactly where people are spending their money and where they are spending their time".

Stakeholder 2: "I honestly do think so. Not only from expanding our client base but also supporting our current client base. And from the sort of the model of a smart city I always say, it's enabling us to gain even more knowledge and understanding of who our clients are - intimate knowledge of our client's needs. So, if everything is connected digitally, and with a technology focus, obviously there's more data that you can tap into, in which you can become more proactive in terms of your offerings to your clients. You can build your client base because you understand a broader part of the people that are available for you to tap into and obviously if you look at the bigger picture, developing our country and our economy and creating employment opportunities. That has a fundamental knock-on effect in terms of growing our business and sustaining our business as a financial services provider".

Stakeholder 3: "In terms of growth yes, they going to have multiple clients. People will be developing their small apps to interface them into banking systems to improve service deliveries to clients in the banking ecosystem".

However, these stakeholders also note that South Africa needs to invest in infrastructure development. As one stakeholder put it "we must get our deteriorating infrastructure repaired and rebuilt before thinking smart cities" (Stakeholder interview, 2023). The country is not on the same level in terms of infrastructure as those listed in Section 4. In addition, the current loadshedding crisis in the country impacts development in the sector to a significant extent.

Also, with the shift to digital, information security is being compromised. With this comes an increased need for banks and other financial institutions to protect their information by establishing a security process that identifies risks, creates a strategy to manage the risks, implements the strategy, tests the implementation of the strategy, and monitors the environment to control the risks.

Furthermore, banking and alternative banking sector stakeholders stated that the sector faces increased regulation which brings about a need for more compliance and risk management personnel to ensure that their organisation operates within the required regulation. This is in addition to the technology related skills financial institutions need to contribute to smart city development, discussed in the next Section.

The Development Bank of South Africa (DBSA) can play a huge role in these policy discussions and can be formalised by characterising the bank as a "policy bank." In the past, DBSA had a strong policy and advocacy role to play, especially in relation to the debate on the role of the developmental state.

Furthermore, the DBSA has a relationship with all the stakeholders in the smart city environment. It plays a key role in infrastructure development and the provision of ICT for development and governance purposes.

5 SKILLS NEEDED IN THE BANKING SECTOR FOR SMART CITY DEVELOPMENT

From the previous chapter, it is clear that banks can make an important contribution to smart cities. For example, a single payment system that works across different public services is an important means by which to finance smart city. Banks can also benefit from smart cities and from the technologies that allow rapid and agile response to customer needs. But smart city technologies need skilled hands. This chapter describes those skills and the availability of those skills in the banking sector.

5.1 Skills required from banks for smart city development

Investments in human capital are required in addition to investments in technology. There is a growing talent mismatch as businesses try to change personnel behaviour while also finding new talent in areas that cannot be automated. Digital skills such as those of artificial-intelligence programmers or data scientists, digital marketers and strategists who can think creatively about new business designs are examples of such areas (Shmeleva et al, 2016). Moreover, a new type of CEO is required, the one who forges the digital transformation internally and externally and ensures that the whole organization is ready to digest new technologies, that IT and marketing can deliver solutions to clients, and that new and the best practices are in place.

Miller (2022) suggests 8 IT professional skills needed to be part of the smart city revolution and that some of these IT-related positions may not even exist yet. Smart city leaders will need IT professionals with critical thinking and problem-solving skills. This will ensure the city stays on track in its development and its technologies function properly. The following are skills that bank professionals must be familiar with:

- i. Mathematics and science
- ii. Artificial Intelligence
- iii. Machine Learning
- iv. Internet of Things (IoT)
- v. Data science and programming
- vi. Robotics
- vii. Engineering
- viii. Computer Vision

According to interviews with stakeholders, the following skills are needed for the sector to advance technologically:

Actuarial science **Data science** **Regulatory skills**
Cognitive thinking skills **Critical thinking skills** **Problem-**
solving skills **Machine learning skills** **Skills around**
environmental sustainability (ESG goals) **Communication skills** **Strategic**
advisory skills **Data management skills** **Data analysis** **Data**
modelling **Data manipulation techniques** **Active listening skills**
Conflict management skills **Time management skills** **Big Data skills**
Ethics around new technology **Compliance and Regulatory skills**
STEM skills **Logical thinking skills** **Agility** **IT engineering skills**
IT architecture **Cybersecurity skills**

Interviewees highlighted that mathematics is a requirement in the sector. And mathematics has been needed for a while, but according to stakeholders in the sector, we now need mathematics in a whole new way. “Because we now need it to understand the maths for algorithms, for coding, distributed ledger, technology and big data”, amongst others. Employees are watching the data and they need to understand the data - “you need to understand what the data is telling you and how the data is being pulled together” (Stakeholder interviews, 2023).

In addition, employees need to understand how to verify data properly and not just assume that the data is correct – “we are desperate, desperate, desperate to massify the mathematics interest... at the moment, the whole world is trying to get their head around machine learning, and the math algorithm and analytical thinking sitting behind that. And trust me, the financial markets, and that includes insurance, traders, the asset managers, the compliance officers” (Stakeholder interview, 2023).

According to stakeholders, organisations developing quantitative analysts are drawing from undergraduate degrees, from engineering to economics to law to actuarial science. “But those are all already high analytical, high problem solving, high mathematical qualifications, and there is a shortage. And the answer cannot be in us all just competing, more fiercely for the same scarce resource” (Stakeholder interview, 2023).

5.2 Do the South African banking sector employees have these skills?

The table below lists the number of banking and alternative banking subsector employees currently employed in occupations needed in smart city development.

Table 2: Current employees with occupations relevant to smart city development

Occupation	Alternative Banking	Banking
MANAGERS	204	2812
2019-132104-Engineering Manager	1	7
2019-133101-Chief Information Officer	29	255
2019-133102-ICT Project Manager	51	424
2019-133103-Data Management Manager	21	688
2019-133104 -Application Development Manager	21	889
2019-133105 -Information Technology Manager	79	547
2019-133106-Information Systems Director	2	2
PROFESSIONALS	1286	13857
2019-212101-Actuary	21	167
2019-212102-Mathematician		5
2019-212103-Statistician	43	811
2019-214101-Industrial Engineer	10	41
2019-214102-Industrial Engineering Technologist		52
2019-215201-Electronics Engineer	1	1
2019-215202-Electronics Engineering Technologist	3	
2019-215303-Telecommunications Network Engineer	8	6
2019-216601-Digital Artist	17	35
2019-216603-Multimedia Designer	4	28
2019-216604-Web Designer	4	19
2019-235601-ICT Trainer	9	8
2019-243401-ICT Account Manager	44	52
2019-243402-ICT Business Development Manager	55	401
2019-243403-ICT Sales Representative	4	12
2019-251101-ICT Systems Analyst	190	2879
2019-251102-Data Scientist	20	121
2019-251201-Software Developer	164	875
2019-251202-Programmer Analyst	29	580
2019-251203-Developer Programmer	174	2976
2019-251301-Multimedia Specialist	11	83
2019-251302-Web Developer	6	11
2019-251401-Applications Programmer	26	184
2019-251901-Computers Quality Assurance Analyst	115	842
2019-252101-Database Designer and Administrator	55	627
2019-252201-Systems Administrator	113	611
2019-252301-Computer Network and Systems Engineer	68	1039
2019-252302-Network Analyst	16	231
2019-252901-ICT Security Specialist	38	619
2019-252902-Technical ICT Support Services Manager	36	522
2019-264201-Copywriter	2	19
TECHNICIANS AND ASSOCIATE PROFESSIONALS	251	1070
2019-311401-Electronic Engineering Technician	97	10

Occupation	Alternative Banking	Banking
2019-315501-Airborne Electronics Analyst		1
2019-331401-Statistical and Mathematical Assistant	1	93
2019-351201-ICT Communications Assistant	61	178
2019-351301-Computer Network Technician	76	328
2019-351302-Geographic Information Systems Technicians	4	430
2019-351401-Web Technician	3	8
2019-352201-Telecommunications Technical Officer or Technologist	9	22
CLERICAL SUPPORT WORKERS	143	394
2019-413101-Word Processing Operator	12	44
2019-413201-Data Entry Operator	128	350
2019-431203-Statistical Clerk	1	
2019-441301-Coding Clerk	2	
SKILLED AGRICULTURAL, FORESTRY, FISHERY, CRAFT AND RELATED TRADES WORKERS	73	81
2019-672203-Computer Engineering Mechanic / Service Person	73	77
2019-672205-Telecommunications Technician		4
Grand Total	1957	18214

Source: BANKSETA WSP, 2022

The table above indicates that the banking subsector has more employees with required skills for smart city development than the alternative banking subsector. The BANKSETA WSP (2022) data suggests that from the 20 171 employees with relevant smart city development occupations, 90.3 % of the current employees are in the banking subsector and 9.7% in the alternative banking subsector. Professionals (which include statistician, industrial engineer, applications programmer etc.) constitute 75% of the total and 15% of managers.

Although, the banking and alternative banking subsectors do employ people with the needed skills to develop smart cities there are still a few Hard to Fill Vacancies (HTFV) and skills gaps in the banking and alternative banking subsectors, as reported by employers in the BANKSETA WSP (2022). The table below lists the occupations that are hard to fill in the banking and alternative banking subsectors and the number of people required to fill these vacancies, as reported by employers submitting WSPs. These occupations are found to be relevant for smart city development.

Table 3: Occupations relevant to smart city development that are hard to fill

Occupation	Alternative banking	Banking
MANAGER		
2019-132104 - Engineering Manager	1	
2019-133101-Chief Information Officer	3	3
2019-133102-ICT Project Manager	16	2
2019-133103-Data Management Manager	8	10
2019-133104-Application Development Manager	5	10
2019-133105-Information Technology Manager	15	9
2019-133106-Information Systems Director	2	
PROFESSIONALS		
2019-212101-Actuary	3	14

Occupation	Alternative banking	Banking
2019-212102-Mathematician	3	4
2019-212103-Statistician	4	3
2019-214101-Industrial Engineer	5	4
2019-214102-Industrial Engineering Technologist		1
2019-215303-Telecommunications Network Engineer		1
2019-216601-Digital Artist	2	
2019-216603-Multimedia Designer	3	4
2019-216604-Web Designer	2	
2019-235601-ICT Trainer	3	
2019-243402-ICT Business Development Manager	7	10
2019-243403-ICT Sales Representative	7	
2019-251101-ICT Systems Analyst	43	26
2019-251102-Data Scientist	9	9
2019-251201-Software Developer	30	19
2019-251202-Programmer Analyst	38	23
2019-251203-Developer Programmer	11	9
2019-251302-Web Developer	4	5
2019-251401-Applications Programmer	34	19
2019-252101-Database Designer and Administrator	11	7
2019-252201-Systems Administrator	8	2
2019-252301-Computer Network and Systems Engineer	37	21
2019-252302-Network Analyst	34	16
2019-252901-ICT Security Specialist	6	10
2019-252902-Technical ICT Support Services Manager	35	21
TECHNICIANS AND ASSOCIATE PROFESSIONALS		
2019-331401-Statistical and Mathematical Assistant	1	1
2019-351101-Computer Operator	1	
2019-351201-ICT Communications Assistant	3	1
2019-351301-Computer Network Technician	5	1
2019-351401-Web Technician	3	4
CLERICAL SUPPORT WORKERS		
2019-413201-Data Entry Operator	1	
SKILLED AGRICULTURAL, FORESTRY, FISHERY, CRAFT AND RELATED TRADES WORKERS		
2019-672203-Computer Engineering Mechanic / Service Person	1	
ELEMENTARY		
2019-862922-Electronics and Telecommunications Trades Assistant		1

Source: BANKSETA WSP, 2022

The table below shows the HTFVs identified by survey respondents in the banking and alternative banking sectors. It is clear that the ICT related occupations are in high demand.

Table 4: HTFV, % of employer responses

Occupations	Alternative Banking	Banking
ICT Project Manager	28.57%	0%
Basic Computer (IT)	32.14%	
Financial Manager	17.86%	
Accounting Manager	17.86%	
Data Management Manager	21.43%	50.0%
Marketing and sales Manager	28.57%	16.67%
Application Development Manager	3.57%	16.67%
Information Technology Manager	10.71%	33.33%
Information Systems Director	3.57%	16.67%
Actuary	14.29%	16.67%
Mathematician	14.29%	16.67%
Statistician	7.14%	16.67%
Industrial Engineer	0%	16.67%
Industrial Engineering technologist	0%	16.67%
Mechanical Engineering Technologist	0%	0%
Telecommunications Network Engineer	3.57%	0%
Digital Artist	7.14%	0%
Multimedia designer	3.57%	0%
Web Designer	7.14%	16.67%
ICT Trainer	10.71%	0%
ICT Business Development Manager	0%	0%
ICT Sales Representative	10.71%	0%
ICT Systems Analyst	7.14%	16.67%
Data Scientist	10.71%	50.0%
Software Developer	25.00%	33.33%
Programmer Analyst	10.71%	16.67%
Programme developer	17.86%	16.67%
Web developer	14.29%	33.33%
Application programmer	3.57%	16.67%
Database designer and administrator	10.71%	16.67%
Systems Administrator	10.71%	16.67%
Computer Network and Systems Engineer	7.14%	16.67%
Network Analyst	0%	16.67%
ICT Security Specialist	10.71%	33.33%
Technical ICT Support Services Manager	3.57%	16.67%
ICT Communications Assistant	0%	0%
Computer Network Technician	3.57%	16.67%
Web Technician	7.14%	16.67%
Artificial Intelligence specialist	3.57%	33.33%
Cybersecurity specialist	21.43%	50.0%
Credit analysts	14.29%	16.67%
Compliance specialist	21.43%	0%
Cloud Computing specialist	10.71%	50.0%
Data scientist	7.14%	33.33%

Occupations	Alternative Banking	Banking
Risk Management Officer	21.43%	0%
Applications programmer	7.14%	16.67%
Computer Network and systems engineer	14.29%	16.67%
ICT Systems Architect	10.71%	33.33%
Debt Counsellor*	3.57%	
Associate*	3.57%	
Securities Trading and Market Making*	3.57%	
Senior Credit Risk Analyst*	3.57%	
Anti Money Laundering Specialist*	3.57%	
Valuation Officer*	3.57%	

Source: BANKSETA WSP, 2022

*The survey made provision for an "other, please specify" option. These occupations were entered by employers.

Data Management Managers, Software Developers and Cybersecurity Specialists are key HTFV in both the banking and alternative banking sectors.

South Africa's migration patterns over the last five years show that parts of the country are experiencing skill and service shortages as a result of people migrating to more developed cities for better opportunities. This, along with the overall shortage of highly skilled occupations, has a negative impact on the development of smart cities, as smart cities will fail if the necessary skills are not available (LGSETA, 2022/23).

During interviews, stakeholders state that there is a shortage of data engineering, data science and data analytics personnel. There is a need for people working in general technology related occupations, or people that work with the technology, for example, coders. And there is a need for people working in data related occupations. The sector has an abundance of data, so they need people that are able to work with the data.

According to stakeholders, there is also a need for business banking advisors that not only understands the banking and alternative banking sector but also the sector they are servicing for example the agricultural or energy sector.

In addition, there is a need for people working in risk related occupations including legal compliance, risk management and occupational risk.

Not having access to people with these occupations slows down the development of the business. The pace of development is compromised or as one stakeholder put it "it is slowing down the rate of change". It also impacts the service to clients.

Also, innovation does not take place as it should – "there are so many golden nuggets that we could probably find with the abundance of data that we have, but with not having those skills readily available, it slows down our being able to process and analyse and come up with business decisions and business insights. Because we are not able to actually sift through that information and find those golden nuggets which would drive our business direction going forward... It is like a treasure chest; we have got different layers. We have opened up the treasure chest and we have got the top layer but we have got so many layers that we can go into further down that we are not able to access because of those skills shortages" (Stakeholder interview, 2023).

And as another stakeholder put it, “the inability to introduce your own products and solutions in this digital space is really constraining... at the moment, the ability to train your machines, and understand what is happening in that space and to interpret Big Data is the biggest constraint that any business in South Africa and the world is currently facing” (Stakeholder interview, 2023).

In addition to HTFV, the subsectors also have Skills Gaps that need to be filled for the development of smart cities. The table below lists the skills gaps relevant for smart city development in the banking and alternative banking subsectors and the number of employees with these skills gaps, as reported by employers submitting WSPs.

Table 5: Skills gaps needed for smart city development

Skills gap	Alternative banking	Banking
Advanced IT and Software	88	50
Basic Computer (IT)	52	13
Mathematics	3	6
Programming	24	28
Science	1	2
System Analysis	37	15
System Evaluation	1	1
Technology Design	28	35
Troubleshooting	12	4

Source: BANKSETA WSP, 2022

In looking at the commonalities, it is shown that advanced IT and software employees (138), Basic Computer (65), Technology design (63), Programmers (52), and System Analysis (52) are required in both subsectors.

In comparing the skills gaps in the table above with the skills needed for the development of smart cities in Section 7.2, it is clear that the sector needs to be upskilled.

In smart city development, empirical studies suggest that the focus should not only be on technological skills, such as coding and developing technology but also on planning and management skills, which are required at governance level. The shortage of skills predominantly in medium-skilled and high-skilled occupations remains an issue that is still to be addressed.

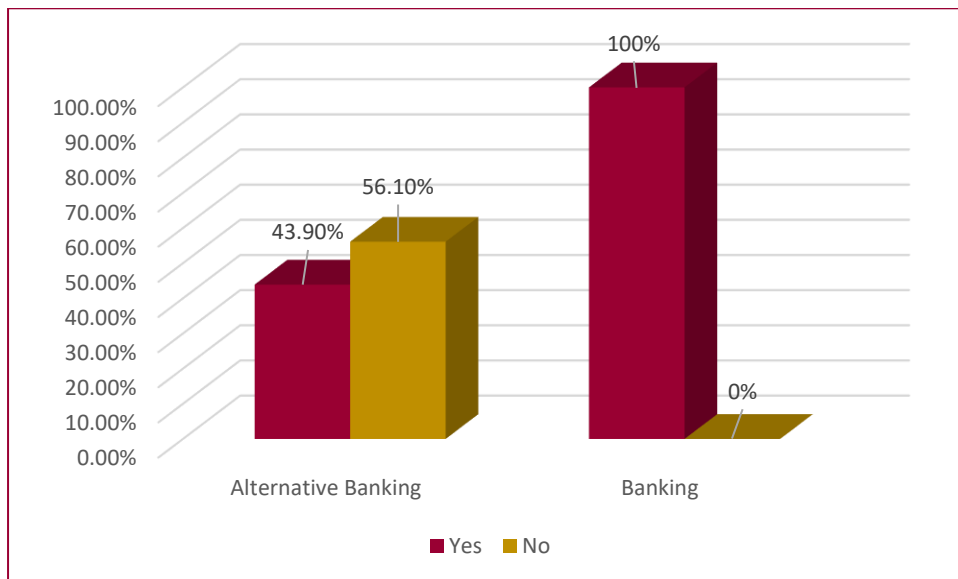
Furthermore, a report by LGSETA (2022/23), highlights that municipalities require skills for planning and managing growing infrastructure needs, asset management, land and property evaluations. The majority of training providers interviewed stated that demand for agile leadership courses has increased. This essentially means that we need leaders who value flexibility, adaptability, and collaboration. This leadership style is ideal for smart cities because it allows leaders to react quickly to changing circumstances and collaborate with stakeholders from various aspects of the smart city concept.

5.3 New and emerging occupations

Some of the occupations that the sector will need to contribute to smart city development are beginning to emerge, according to the survey. These occupations are especially important now that the world is moving toward digitisation and technology, which is changing the customer experience, particularly in the aftermath of the Covid-19 pandemic.

In the survey, all banking subsector employers indicated that there are new and emerging occupations in the sector, whereas 43.9% of alternative banking subsector employers indicated that there are new and emerging occupations and 56.1% indicated that there are none.

Figure 3: Are there new and emerging occupations in the sector?



Source: BANKSETA Survey, 2023

It appears that new and emerging occupations are more apparent in the banking subsector than the alternative banking subsector.

Employers who indicated that there are new and emerging occupations in the sector selected the occupations in the table below:

Table 6: New and emerging occupations needed for smart city development, % of employer responses.

Occupation	Alternative banking N=17	Banking N=5
Mixed reality experience designer	17.65%	20.0%
Algorithm mechanic	5.88%	0%
Conversational interface designer	0%	20.0%
Universal service advisor	5.88%	0%
Digital process engineer	41.18%	40.0%
Partnership gateway enabler	11.76%	20.0%
Solution architect	23.53%	20.0%
Blockchain architect	23.53%	20.0%
Machine learning specialist	29.41%	80.0%
Data engineer	11.76%	60.0%
Robotics Engineer	23.53%	20.0%
Robot Technicians	11.76%	20.0%

Occupation	Alternative banking N=17	Banking N=5
Digital Organisational Reporting Officer*	5.88%	
Building Technology Machinery*	5.88%	
Corporate Writer*	5.88%	
Mixed Reality Experience Designer*		20.0%

Source: BANKSETA Survey, 2023

* The survey made provision for an "other, please specify" option. These occupations were entered by employers.

Digital process engineers, Solution architects, Blockchain architects, Machine learning specialists, Data engineers, and Robotics engineers are rising in importance in the sector.

The reasons given for these new and emerging occupations include digitisation and technology, changing customer expectations, greater security risk in the sector, and competition.

Table 7: Why are there new and emerging occupations in the sector, %of employer responses

Reason	Alternative Banking	Banking
Digitisation and Technology	76.47%	80.0%
Changing customer expectations	47.06%	40.0%
Damage to banking infrastructure	23.53%	20.0%
Cost management	11.76%	0%
Greater security risk in the sector	35.29%	40.0%
Regulatory changes	23.53%	0%
The impact of Covid-19 pandemic	29.41%	20.0%
Competition from Banking/Alternative banking sector	35.29%	80.0%
Development of smart cities	17.65%	0%
Reporting requirements*	5.88%	

Source: BANKSETA Survey, 2023

* The survey made provision for an "other, please specify" option. These reasons were entered by employers.

Interviewees listed some occupations that are gaining in importance due to the changing technological environment. Some of the key points are listed below:

- AI is gaining more mainstream exposure in the banking and alternative banking sector. With it comes a rise in AI related occupations such as **data analysts, data scientists, AI programmers**, amongst others. Increasingly financial institutions are using AI to customise product offerings based on an analysis of customer data. Also, these institutions are using AI to manage risks. As one interviewee stated, "how do we manage large datasets that have become so prevalent in organisations, even more so in banks with access to this data, but actually to translate that data into value? And the value is around personalisation of experience, or detection of fraud, or more better managing risk, more behavioural aspects in terms of credit application scoring, etc" (Stakeholder interview, 2023).
- **Machine learning** is a new and upcoming occupation.
- **Blockchain** is becoming a bigger player in the way that banks are structured around decentralised ledgers and the ability to be able to create unique transactions or unique

identifiers without having to trace it back – “So we are probably going to see some more needs over the next five to 10 years around blockchain” (Stakeholder interview, 2023). Another stakeholder stated that “Blockchain technology will increase as the development of smart cities continue to gain momentum” (Stakeholder interview, 2023).

- These changes create a greater challenge around risk management. **Risk manager** is not a new occupation, but employees will need to manage risk in an environment where there is blockchain for example, so skillsets will need to be updated. It “is not necessarily a new role, but it will be evolving more into the IT stream” (Stakeholder interview, 2023). One interviewee stated that “how do we think of regulatory compliance, risk management and how you manage complex regulatory environments where we have got things like cryptocurrencies, new forms of capital, faster movement of money, alternative options coming through, become particularly important” (Stakeholder interview, 2023).
- With the move to AI, including blockchain technology, or cryptocurrency or digital currency, there is a bigger need for **cybersecurity personnel**. This is an evolving occupation because “what happened two years ago is fundamentally different to what it is like today” and as such employees need to be certificated often (Stakeholder interview, 2023).
- **Ethical hackers** will gain in importance. “Basically, they are hackers that come in and try and break your systems, but they do it by saying... hey, this is how we broke the system, or this is how we entered the system, and here are the areas where there are risks. If you pay me x amount, I will tell you how to fix it or I will tell you how I did this. So, you know those ethical hackers are probably something that we will see more and more of...so I think it has been around for a while. But I do not think we have leveraged it enough as we move into this digital space. It is going to be more and more of a requirement for us to test the security and protection of the information we have” (Stakeholder interview, 2023).
- **Cloud engineers**.
- Occupations around enhancing the customer experience is gaining in importance such as **customer relationship managers**, and **product developers** or **designers**. Elevating customer centricity and the user experience through design thinking. As an interviewee put it “building the right type of design elements into our services, into our offerings, in our products, into the ways in which we do things” (Stakeholder interview, 2023).
- Because of the push towards Environmental, social, and governance (ESG) in the sector, occupations in line with this are needed. One interviewee asked, “how do we build more sustainability understanding into our operations, in investment strategy, into our risk assessment, into our understanding of green technology?” (Stakeholder interview, 2023).

According to an interviewee, occupations such as **AI Robotics**, **Data analysts** and other technology occupations are not new, however, the technology behind those occupations are constantly evolving. As such, people employed within these occupations need to constantly be upskilled – “rather the skills underlying and how we actually approach upskilling who is actually currently in our organisation sitting in a role that is changing. As an example, an actuary. Actuarial science has become very much a focus area because of the sort of analysis of data, but the manner in which the actuary functions has changed.... And our client facing roles, we are expecting that client facing position that person to be able to advise on a variety of different things. Whereas in the past, we had specialists... the business banking advisor, the personal banking advisory, the private banking... and we more and more are finding that we need that person that is a has a holistic approach” (Stakeholder interview, 2023).

Another example is around financial advisors. Because of the rise in “Crypto activities and Crypto financial products”, financial advisors need to be upskilled in how to advise clients in the crypto environment. Again, not a new occupation but rather a change in the way the job is done.

Also, legal personnel need to be upskilled to look at new technological developments from a regulation point of view. They will need to advise financial institutions on whether they are allowed to use certain technologies in terms of regulation.

Another stakeholder stated that auditing will change. The way in which information is audited in a digital and crypto currency environment is different to how it was done in the past, “because you cannot necessarily identify the specific transaction because each transaction builds on each other”.

One stakeholder explained “we have long had computers trading without humans, but they are trading against the rules as they are built into the algorithms. Now the computers are learning on their own and they are changing the rules without humans knowing what the changes are. Humans now need to understand what changes are being made underlying the algorithms that were initially programmed into the computer. So, the machine learning and understanding how that machine learning is happening, and the governance rules around it...And then the calculations of risks and trends is the old fashioned accounting understanding, reading the annual financial statements to see if there is value in a product, is really being replaced by predictive trends that big data can show in a way that we have not been able to do before. And that again, means that you need to understand differently” (Stakeholder interview, 2023). In sum, job functions are changing of existing occupations.

5.4 Factors hindering the uptake of Smart City Development

According to the survey, both the banking and the alternative banking sector employers indicated that there are factors hindering the uptake of technological advancements at their institutions.

60% of banking subsector employers indicated that there are factors hindering the uptake of technological advancements at their bank and 40% indicated that there are none. Similarly, in the alternative banking subsector, 51.3% indicated that there are factors hindering the uptake of technological advancements and 48.7% indicated that there are none.

These hindering factors could limit Smart City development in South Africa. The table below shows lack of experienced professionals is a key hindering factor for banking and alternative banking sector employers. Other factors include cybersecurity risks, inconsistent network connectivity, with the alternative banking sector highlighting insufficient funds and regulatory approval and licensing.

Table 8: Hindering factors to take up technological advancements, % of employer responses

Hindering factors	Alternative Banking	Banking
Cybersecurity risks	45.00%	33.33%
Inconsistent network connectivity	30.0%	33.33%
Lack of experienced Professionals	60.0%	66.67%
Insufficient funds	75.00%	0%
Regulatory approval and licensing*	10.0%	

Source: BANKSETA Survey, 2023

* The survey made provision for an “other, please specify” option. These factors were entered by employers.

The table above show that to a great extent, the sector still requires significant skills development in order to contribute effectively and efficiently to the development of the Smart Cities.

According to the survey respondents, the sector has an inconsistent network; this speaks to the country's overall technological infrastructure. One of the interviewed stakeholders' states that "I believe the alternative banking sector can certainly contribute to the development of smart cities and provide adequate infrastructure which will be created for this [seeing that this will require unbroken dependable infrastructure] (Stakeholder interview, 2023)".

Furthermore, according to the survey, banking subsector employers either purely use cloud-based deployment models of information technology (20% of employers) or hybrid deployment which is a mixture of both cloud-based and on-premises deployment (80% of employers). Whereas alternative banking subsector employers either use cloud-based deployment (48.7%); on-premises deployment (35.9%); or hybrid deployment (15.4%). As shown in the table below, a significant proportion of alternative banking subsector employers only use on-premises deployment (35.9%). Pointing to a lack of technological development within the subsector.

Table 9: Information Technology Deployment models used at organisation, % of employer responses

Information Technology deployment model	Alternative Banking	Banking
Cloud-based deployment	48.72%	20.0%
On-premises deployment	35.90%	0%
Hybrid deployment	15.38%	80.0%

Source: BANKSETA Survey, 2023

6 EDUCATION, TRAINING AND DEVELOPMENT NEEDED FOR THE SECTOR TO FUNCTION IN A SMART CITY CONTEXT

The 2021 Smart City Framework asks whether we will need to hire people with specialised skills and experience to implement a specific smart city initiative. Would we be able to train current employees to operate and maintain technologies associated with a smart city initiative? What skills and competencies will we need in the future to support and sustain smart interventions? Are our politicians and officials willing and able to embrace change and accept innovations and smart interventions? Do all parties involved have the same vision? All of these questions attempt to determine the skills that our country possesses and where we need to develop and grow.

According to Sidler (2016), South Africa's major cities must have a defined 20-40-year plan in place, as well as a long-term vision, in order to accommodate this projected growth. The presence of people and human resources, not just technology, is what makes a city smart, as per the 2021 Smart City Framework. This is the primary reason why municipalities will need to invest in human resources in addition to technology and data.

The available literature suggests the same thing as the stakeholders interviewed. Some interview quotes are stated below:

Stakeholder 1: "Although human capital development does not happen overnight, the earlier we begin, the sooner we will have adequate human resources. The main challenge for South Africa in the national progression of smart cities is a lack of professional, tech-savvy individuals who understand and can use IT systems under pressure".

Stakeholder 2: "To permit smart city implementation, having people with the right skills and abilities in the right places is critical. One of the main ways the banking sector can contribute to the development of smart cities is by availing funding for different components of a smart city; this is something they will efficiently do as they have detailed processes in place".

The survey analysis suggests that the global business economy is changing, and employers are attempting to adapt quickly and effectively. They recognise the significance of employee education and development. This is frequently accomplished through training, job rotation, coaching or mentoring, and shadow learning (BANKSETA Survey, 2023).

6.1 Overview of Education, Training and Development

The Statistics on Post-School Education and Training (PSET) report (DHET, 2020) states that in 2020, there were 343 institutions in the PSET system. The 343 institutions are made up of:

- 26 public Higher Education Institutions,
- 124 private Higher Education Institutions,
- 50 Technical and Vocational Education and Training (TVET) colleges,
- 133 registered private colleges, and
- 9 Community Education and Training (CET) colleges.

Figure 4: Overview of PSET and student enrolment, 2020

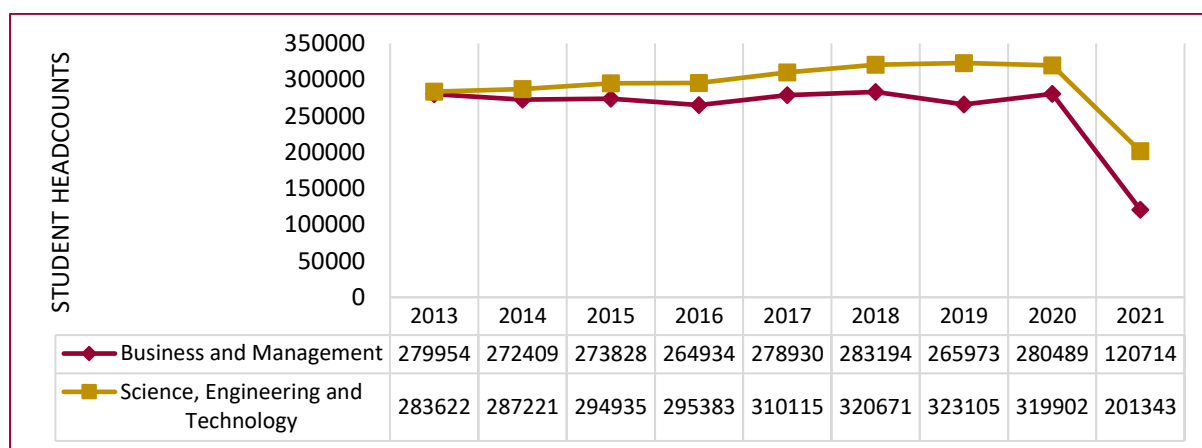
	HEIs			Colleges				Total PSET
	Public	Private	Total	TVET	CET	Private	Total	
# institutions	26	124	150	50	9	133	192	342
# students enrolled	1 068 046	232 915	1 300 961	589 083	143 031	85 787	817 901	2 118 862

Source: Statistics on PSET report, 2022

According to the BANKSETA SSP (2021), the “common fields of study that offer a supply stream for the banking sector are Bachelor of Commerce; Bachelor of Science: Actuarial/Financial Mathematics; Bachelor of Business Administration; Bachelor of Science: Engineering/Applied Mathematics/Computer Science; Bachelor/Master of Law: Corporate Law; Bachelor of Accountancy. There are in some cases intakes from Bachelor of Arts: Psychology and Bachelor of Social Science: Human Resources. The bulk of the supply falls within the business and management streams. In recent years, the sector has demanded graduates with a qualification in Information Technology, Mathematics and Statistics, Data Analytics, Programming, and Engineering”.

The figure below shows that after a gradual increasing trend in enrolments in SET and Business and Management subjects at HEIs between 2013 and 2020, there was a sharp decline in enrolments in 2021.

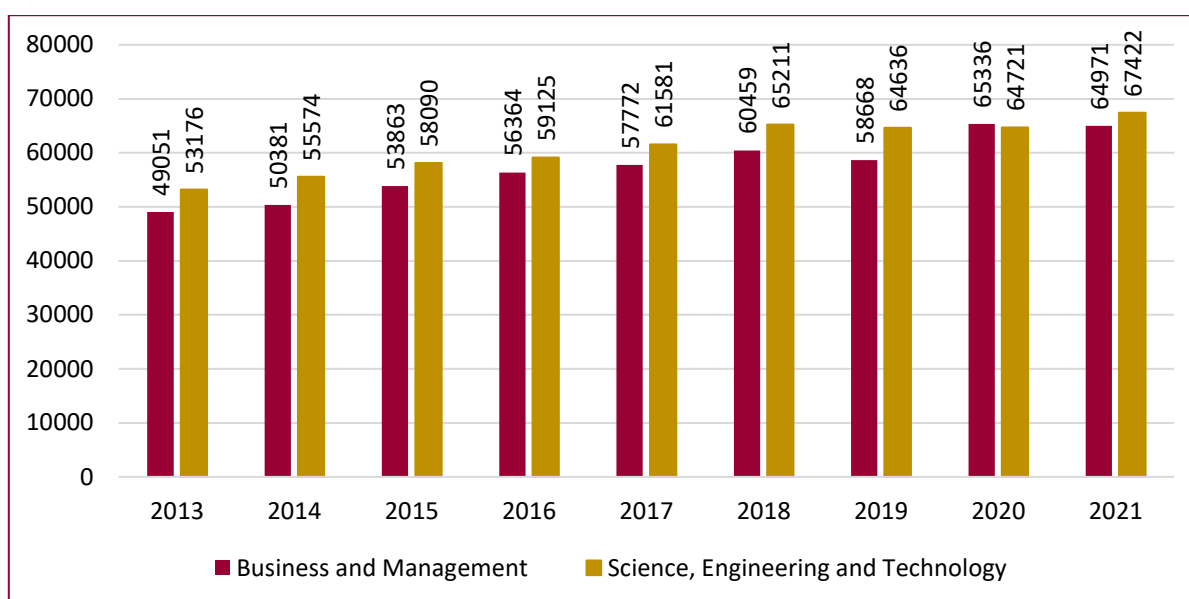
Figure 5: Number of students enrolled in public HEIs by major field of study, 2013-2021



Source: Statistics on PSET report, 2023

Completions from South African public HEIs in relevant subjects steadily increased between 2013 and 2021, indicating a general increase in the level of potential skills supply for the finance and accounting services sector.

Figure 6: Number of students graduated in public HEIs by major field of study, 2013-2021



Source: Statistics on PSET report, 2023

Interestingly, more Business and Management students complete their studies as opposed to SET students.

There was an overall increase in enrolments in TVET colleges between 2020 and 2021, from 421 544 to 558 717 enrolments in TVET colleges.

The BANKSETA implements numerous programmes that link to qualifications required by the banking and alternative banking sectors. These qualifications are offered through the BANKSETA learnership programmes, bursaries, skills programmes, or work-based learning programmes. The tables below provide information on the registrations and completions of BANKSETA funded programmes for employed and unemployed learners during the 2021/22 period.

Table 10: Number of workers and unemployed registered in SETA-supported learning programmes, 2021/22

SETA	Learnerships			Skills Programmes			Internships
	Workers	Unemployed	Total	Workers	Unemployed	Total	Unemployed
BANKSETA	1 614	1 201	2 815	148	58	206	509

Source: Statistics on PSET report, 2023

The table above shows that in 2021/22, 2 815 learners registered in BANKSETA supported learnership programmes. This is significantly more than internships (509 learners) and skills programmes (206 learners).

The table below shows that total certifications in BANKSETA supported learning programmes is much lower than registrations. However, it should be noted that certifications in learnership programmes are more than registrations (1 646 certifications in 2021/22).

Table 11: Number of workers and unemployed certificated in SETA-supported learning programmes, 2021/22

SETA	Learnerships			Skills Programmes			Internships
	Workers	Unemployed	Total	Workers	Unemployed	Total	Unemployed
BANKSETA	1 646	96	1 742	162	0	162	183

Source: Statistics on PSET report, 2023

According to BANKSETA (2022) the majority of the TVET colleges in South Africa have limited capacity to develop ICT skills required by banking and alternative banking. While some institutions offer computer courses these are largely at National Certificate Vocational (NCV) level and very few offer information technology programmes at National Accredited Technical Education Diploma (NATED) level.

6.2 Education and Training programmes that address the occupations needed in the sector

Numerous public and private college and HEIs offer programmes that are relevant to the identified occupations needed in the sector. Some of them are provided below:

Table 12: Education and training programmes on offer, not at all inclusive list

Name	Duration	Modules
Universities/ Higher Education Institutions		
UNISA Course: Money and Banking	One Semester	Description: This module will be useful to students who are following or planning to follow a career in banking. It aims to give a unique understanding of the dynamic and evolving nature of the financial system and how it is related to the aggregate economy. This module offers discussions on theory, institutions, and policy as they relate to changes in the financial system, as well as an analytical foundation for understanding these changes. It is designed to introduce students to the study of money and banking as well as financial market analysis.
University of Johannesburg	Period varies	<ul style="list-style-type: none"> • Certificate of Cyber security • Intelligent System Development (Using TensorFlow) • 4IR online courses
Nelson Mandela University	Period varies/available on request	<ul style="list-style-type: none"> • Management leadership programmes • SETA accredited programmes
Private training providers		
Johannesburg Institute of Engineering and Technology	One Semester	<ul style="list-style-type: none"> • Personnel Management N4 • Entrepreneurship and Business Management N4 • Financial Accounting N4 • Introductory Accounting N4 • Management Communication N4

Name	Duration	Modules
Course: Financial Management		<ul style="list-style-type: none"> • Business Communication N4 • Computer Practice N4 • Introductory Computer Practice N4 • Economics N4
Damelin School of Banking	91 hours	<ul style="list-style-type: none"> • Banking related direct selling techniques • Bank products and services • Product features, advantages and benefits to the customer
Chartall Business College	10 months	<ul style="list-style-type: none"> • Demonstrate an understanding of the functioning of the international financial markets within the South African context; • Analyse and evaluate the financial markets Apply basic economic principles to the financial services sector. • Enhance work practices within a treasury by the application of market knowledge in a banking environment; • Identify the risk implications of trading associated within a treasury in a banking environment; • Evaluate companies based on their financial statements <p>Electives:</p> <ul style="list-style-type: none"> • Explain the structure and mechanics of Financial Markets; Demonstrate an understanding of the use of micro- and macro-economic indicators as forecasting and planning tools within the financial markets; • Operate within the ethical, professional and legal limits of the South African and international legislation and codes of practice regulating the financial markets; • Identify and control risk within the financial markets; Complete and submit reports within the financial markets sector as required by legislation and by company policy; • Calculate and analyse investment performance
Milpark Education Course: Higher Certificate in Banking Services	1 year	<ul style="list-style-type: none"> • Regulation and Compliance in the Banking Industry • Fundamentals of Retail Banking • Customer Service and Communication • Introduction to Sales • Fundamentals of Economics • Introduction to Business Management • Personal and Small Business Credit • Principles of Accounting • Fraud Detection
The Sherq Centre of Excellence (Pty) Ltd	12 hours	<ul style="list-style-type: none"> • Introduction to 4IR and Digital Banking Online • Philosophy of AI Phase 1 • Philosophy of AI Phase 2

Name	Duration	Modules
Walt Productions (Pty) Ltd t/a Ethics Africa	18 hours	<ul style="list-style-type: none"> • Financial Intelligence Centre Act • Financial Services Debarment Process • Regulations of the Financial Sector in South Africa • New Regulatory Structure of the FSCA
Growth in Motion Pty Ltd	16.5 hours	<ul style="list-style-type: none"> • Economic, Social and Governance (ESG) considerations. • Digital Communication in the FAIS environment. • Common Advisor concerns and how to face them. • Leveraging tech for a better client experience. • Alternative Investments. • Forex Investments.
Duke Corporate Education	Available on requests	The organisation offers custom made training programmes. Designed in collaboration with clients in the sector.
Novia One	12 Months	Financial Markets & Instruments.
SACOB		<ul style="list-style-type: none"> • Professional qualifications and short courses • Administration • Bookkeeping • Accounting • Business Management • Chartered Secretary • Entrepreneurship • Financial Analysis
The Learning Organisation	Period varies	Short courses in IT, business, management, marketing and finance

In addition to the list above, in the quest to integrate digital skills knowledge into the current TVET college programme offerings, the DHET has partnered with CISCO and HUAWAI to update the existing curriculum to align with industry demands in the digital skills area. Furthermore, there is a new stream focusing on Robotics in the NCV: Information Technology and Computer Science programme which previously only focused on programming and systems development. The Minister of Higher Education, Blade Nzimande (2022) added: “under the CISCO agreement, at least 300 lecturers are being trained in our 50 TVET Colleges to upgrade their skills on Information Communication Technology (ICT) related NC(V) qualifications”. Under the HUAWAI agreement, lecturers currently at 32 TVET colleges are being trained to support the introduction of subjects such as Routing and Switching, Big Data, Artificial Intelligence, WLAN, and Security and Cloud Computing (DHET, 2022).

According to interviewees, employers provide in-house training to upskill employees. Often these take the form of structured programmes. In addition, employers provide bursaries and scholarships to unemployed and employed individuals to complete education and training programmes.

Industry associations provide education and training to graduates in the sector often in the form of structured internship or graduate development programmes.

6.2.1 Relevance of Education and Training Programmes

During interviews, a stakeholder stated that their organisation only recruits tertiary education graduates and above. These graduates are recruited into internship positions or graduate development programmes. So, graduates coming from tertiary institutions are not ready to become independent employees at their organisation. These graduates need to undertake structured development programmes first.

This is supported by another stakeholder who stated that “people are recruiting at a post grad level and not at the bachelors level. And that is because their bachelor's level is not sufficiently positioning”.

According to the stakeholder, graduates coming into the system are not “adequately prepared”, mostly in work readiness. This is why internships and graduate development programmes are key. As the stakeholder put it “introducing programmes like your graduate development programmes and your internships, is really assisting us to inculcate or instil professional values that we want our graduates to come with, so they do not come really well rounded. You need to provide top up skills in a form of any feeder programme” (Stakeholder interview, 2023).

In terms of technical capabilities, according to the stakeholder, graduates come prepared in “traditional” qualifications but not in “futuristic” qualifications. These qualifications are in the areas of data analytics – “you do not have a sufficient pool to recruit from when you look at the ICT environment, particularly in the engineering side of things...and cybersecurity issues” (Stakeholder interview, 2023).

However, an industry association representative stated that tertiary institutions put in the effort to stay relevant. As the stakeholder put it “they (University) have tried to reevaluate the programme all the time... they already have things like BLT in the syllabus, they have got financial maths that is looking at AI and machine learning as part of it, they are looking to partner with the IT department computer science departments. They know what they have got to do... they are adding more predictive and new thinking into maths. They know they have to. I do not think historically, there was such a thing as a financial risk management honours, that looks specifically at quantitative analysts development. I think these are all new qualification so that academics are stepping up” (Stakeholder interview, 2023).

According to education and training providers, their programme offerings are relevant. This is because they constantly review their programme offerings to stay updated with the rapidly changing technological environment. Programme reviews often involve academics and industry to ensure that programmes are in line with industry requirements.

In addition, to keep up with the changing times, education and training providers have shifted their mode of delivery to various extents. Some have completely gone virtual whilst others have a mix of face-to-face and online programme offerings.

Some education and training providers stated that programmes that are increasing in importance are around compliance/operational and risk management because of the increased risk brought on by technological transformation; relationship banking because of the increased need to be client centric; courses on FinTech and innovation in the sector; management courses such as agile leadership, authentic leadership, and performance management; digital marketing analytics; cybersecurity; AI for business professionals; amongst others.

6.2.2 Challenges in the Education and Training system

Stakeholders in the sector highlight that too few people undertake STEM disciplines. Too few learners at schools choose to complete STEM related subjects. Then too few students enter these subjects at Universities and other education institutions and then ultimately significantly less than required graduates enter the sector to be upskilled and gain the necessary experience by employers. As one interviewee puts it - “the kids are filtered out of from STEM disciplines at school and then whoever is left they start failing at university and then we end up with a small group of individuals that we are able to tap into from a talent perspective. We do offer training, but we need those STEM disciplines in place and established before we can actually work with that employee in terms of the gaps that we find” (Stakeholder interview, 2023).

Another stakeholder stated that “making those kind of subjects compulsory would be a way for us to be able to change the way people think”. According to the interviewee employees must be able to understand how to solve a problem - “you get put in front of you a specific formula, and you have got to solve for x or y. It changes the way you think and your approach to issues. It gives you different ways to be able to solve the equation” (Stakeholder interview, 2023).

When asking one interviewee where South Africa’s greatest weakness is, the interviewee stated “Analytical thinking and mathematics and secondary schooling” (Stakeholder interview, 2023).

In support of this, another stakeholder stated that currently in South Africa there is “a major pipeline channel problem. You cannot put a million people into a system and get 2 out of higher education... 7754 matriculants with a distinction in maths to feed into higher education pipeline is just not sustainable”. And then these matriculants are split between a range of qualifications such as medicine, computer science, and actuarial science, amongst others. The stakeholder stated that what further complicates this problem, is that students end up doing degrees that are funded as opposed to what is needed.

Thus, there is a need to “get more people through university because at the moment only 27% are getting through in minimum time”. This negatively impacts businesses in the sector as they are not recruiting the required number of people. A stakeholder emphasised that “34% of our members in May this year [2023] say they have not managed to fill the graduate entry level jobs in May (and this is not happening for 10 years.... not a new thing). Another stakeholder stated that “they (businesses) are at the moment competing fiercely for those few numbers” (Stakeholder interview, 2023). The same stakeholder stated that there is “a bank that has got two strategic programmes for recruitment. The one is the CA programme... and the second one is for quantitative analysts. And I think they have got 60 positions and I think they are lucky if they fill 5 or 10 of them”. (Stakeholder interview, 2023).

Clearly, the skills needed for the current technological transformation taking place in the banking sector is not available in the required quantities nationally, with one stakeholder stating that it is “scarce both from a local and global perspective, specifically in the IT space” (Stakeholder interview, 2023). Another stakeholder stated that “there is quite a seismic shift in the way in which business is conducted in the financial market, and that is requiring a new breed. And that new breed does not exist. At least not sufficiently” (Stakeholder interview, 2023).

According to stakeholders, the transition from school to tertiary education and from tertiary education to the work environment is hard. The first year at university is a shock which increases dropout rates. Also, the transition from tertiary education to the work environment is challenging for employees, specifically in relation to soft skills. Soft skills such as “how to influence, how to position yourself, how to speak, what to say, how to say things, just the kind of workplace etiquette, is something that we

find missing... secondary and tertiary education needs to shift for us to be able to build the skills we need in the future” (Stakeholder interview, 2023).

During interviews, stakeholders stated that some skills development programmes offered by education and training providers are not relevant to what the industry needs. An employer stated that “they should structure their programmes in a way in that people are upskilled in these scarce skills that we are looking for”.

One training provider stated that it is a challenge to keep people’s attention during courses – “Throughout the process. It seems that attention spans are shorter, and I think it is from wellness and general exhaustion because of the pace at which things are moving and just the volume of things that happening at the same time”. Another challenge for providers is internet connectivity. Many of them went online, and coupled with loadshedding schedules, students are not able to complete assessments. They are experiencing a low pass rate for online assessments.

Stakeholders noted that poaching happens in the banking sector. Whilst employer and industry associations realise the importance of upskilling employees in the sector, they are also aware of the increased cost and waste of time associated with upskilling employees who leave shortly after completing their training. One stakeholder stated that “the interesting thing is that, in my experience, the banks are building new and emerging skills. And the management consultants are not keeping up with it. And therefore, they are having to hunt and steal and borrow and take from industry, from the banks” (Stakeholder interview, 2023).

In addition, experienced professionals are emigrating which causes businesses to lose key skills. Also, experienced people are retiring. According to a stakeholder, this is a challenge in the tertiary education sector as maths academics are retiring – “their biggest problem is that they cannot retain maths academics”.

6.3 Conclusion

If the banking sector is to contribute to, as well as to benefit from smart cities, then it will need to invest in the technology skills that undergird smart cities. These skills are in short supply and there is competition for graduates from universities and colleges. The banking sector may need to help build the pipeline of skilled people from high school, encouraging youngsters to choose careers in ICT and then assisting from the transition to university or college and then on to the workplace. In addition, on-going training is critical to ensure those in the banking sector are upskilled to develop and use technology central to smart cities.

7 CONCLUSION

The purpose of the study was to utilise literature and primary data to study the smart city concept and its implications for the banking sector in South Africa.

The research questions for this study are:

- What role can the banking sector play in Smart Cities?
- Does the banking sector currently have the skills required to fulfil this role?
- What training is needed to prepare the banking sector to function within a Smart City context?

It is clear that various people have diverse meanings for the term "smart city." How smart city programmes are implemented differs significantly between countries and cities. Therefore, understanding the specific local context is essential to understanding how the idea of a smart city is to be understood in South Africa. Only then can an intervention be developed that appropriately addresses the specific needs, challenges, opportunities, and aspirations of the local authority and everyone it serves. Moreover, there is an increasing demand for new and futuristic skills to manage a smart city successfully. Thus, working professionals must upgrade their skills regularly and invest in up-skilling to stay relevant.

Banking is the foundation of the modern monetary system. As cities become smarter, there is an ample opportunity for financial systems to be integrated. Banks can act as catalysts for change in how municipalities and metropolitan areas operate. A bank's participation in advancing a city's smart aims will include paperless banking, integration with personal identification and financial records, mobile payments, and system integration with municipal operations; all of these are vital services for a smart city. However, the extent of data sharing must comply with data protection laws and be approved by customers.

The smart cities concept provides numerous opportunities to deliver new and improved services at a low cost. Adopting the collaborative approach allows cities of all sizes to explore promising technologies, determine which ones best meet their specific needs, and then integrate those new solutions into the fabric of municipal life. It is vital to note that smart city development needs different role players, from technologists, legal people, engineers, governance experts and many more. The new and emerging occupations associated with developing the smart city concept require modern, also known as future education, which should be compatible with the knowledge and technological advances needed in smart cities.

This research shows that BANKSETA can currently contribute to the development of strategies and the incremental implementation of smart cities in South Africa. The study revealed that banks need more specialised IT skills and agile leadership, technical skills, data literacy, and analysis skills.

7.1 Recommendations

Based on the findings of the study, it is recommended that the BANKSETA focus on supporting skills development in seven distinct ways for the support of smart city development in South Africa, as follows:

- In the banking sector, there is a need for the staff to be upskilled in digital skills as well as the operation and management of smart infrastructure. It is recommended that the BANKSETA

fund skills development programmes targeted at the sector to be offered through qualified training providers.

- There needs to be improved access to career development opportunities for students. The BANKSETA can promote and fund WIL programmes and internships for youth to easily progress from education and training providers to the workplace.
- The BANKSETA can influence the choices of the country's youth in terms of school subjects that will allow them to pursue career opportunities that will impact smart city initiatives. It is recommended that the SETA implements career awareness initiatives around the development of smart cities, directing youth to take on STEM subjects and allowing them to access programmes needed in the smart city context.
- The SETA should focus on programmes that facilitate entry into the banking sector for the youth. These programmes should focus on building capabilities that will be needed in the future.
- Funding is also scarce for college and university students; BANKSETA could consider increasing funding in higher education learning institutions and allowing for skill development in the faculties of science, technology, engineering, and mathematics.
- Some South African tertiary institutions, such as the UKZN, are offering skills development in future 4IR skills, such as quantum computing; it is recommended that the BANKSETA consider funding such skills. The BANKSETA can help build much-needed skills while promoting new thinking in how South African cities are run by funding students, particularly those already pursuing future skills.
- BANKSETA should partner with tertiary institutions, particularly those interested in smart city development. The Universities of Pretoria and Stellenbosch are conducting research and developing certain aspects that will aid in developing South African smart cities.

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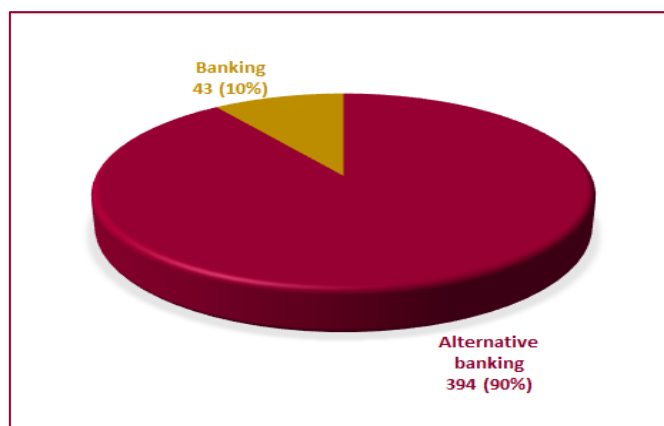
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Appendix: Employers and employees in the sector

Number of employers per BANKSETA subsector

According to the SARS Levy data, over 700 employers pay skills levies to the BANKSETA. The BANKSETA Workplace Skills Plan (WSP) data (2022) shows that there are 437 employers submitting WSPs to the SETA. The figure below shows that the large majority of employers are in the alternative banking subsector (394 or 90%), with only 43 (10%) employers in the banking subsector.

Figure 7: Number and proportion of employers per subsector

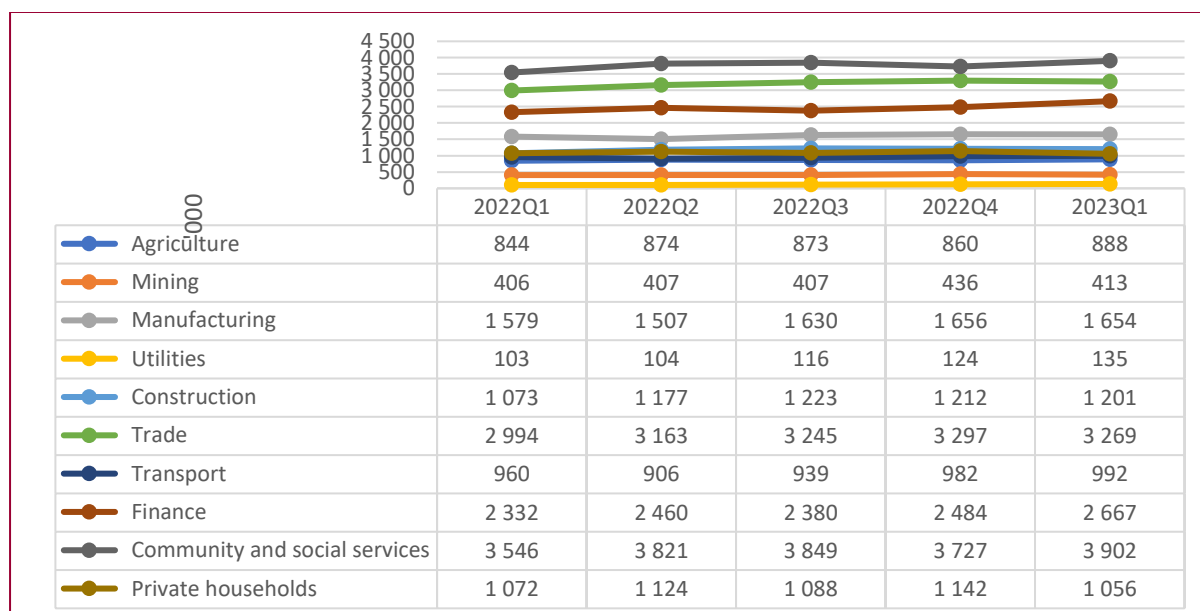


Source: BANKSETA WSP, 2022

Number of employees

In the South African economy, the sectors with the largest number of employees are community and social services, trade and finance.

Figure 8: Number of employees, 2022Q1 - 2023Q1

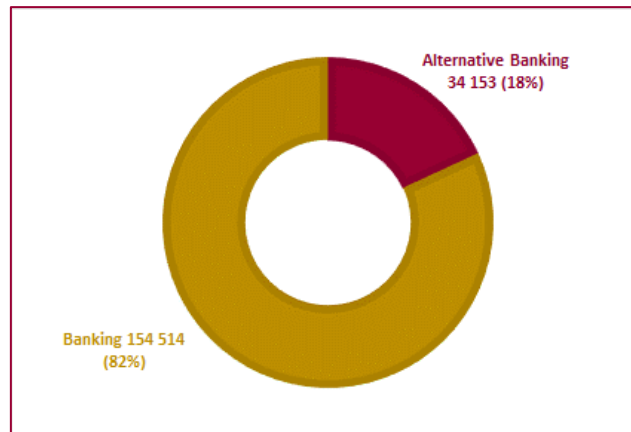


Source: StatsSA, 2023Q1

The number of employees in the finance sector ranged between 2.3 million and 2.7 million during the 2022Q1 and 2023Q1 period, reaching 2 667 000 employees in 2023Q1.

According to the BANKSETA WSP (2022) submissions, employers that submitted WSPs employ 188 667 workers. The figure below shows that the large majority of employees are in the banking subsector (154 514 or 82%) with only 34 153 (18%) employees being in the alternative banking subsector.

Figure 9: Number and proportion of employees per subsector

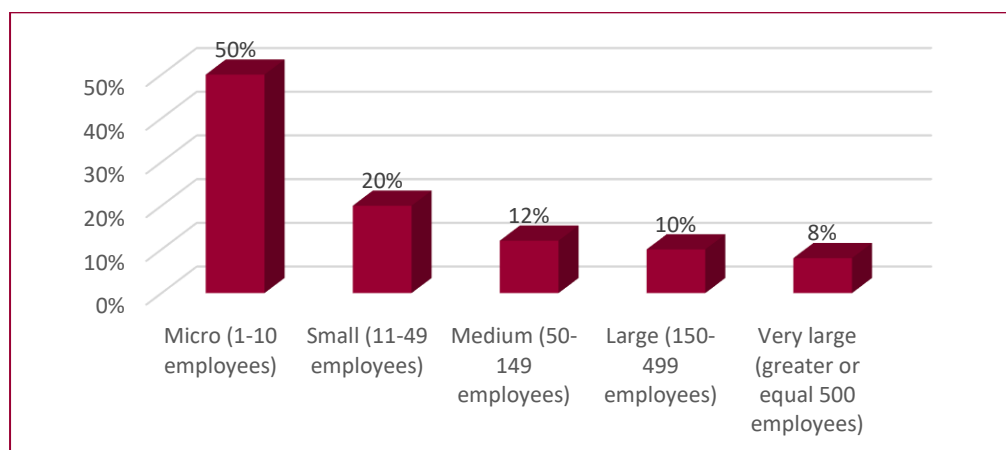


Source: BANKSETA WSP, 2022

It should be noted that the bulk of the employers are in the alternative banking subsector, but the majority of employees are in the banking subsector, indicating that most employers in the alternative banking subsector are small and the majority of employers in the banking subsector are large.

A survey was conducted for employers in alternative banking and traditional banking sector. A vast majority (50%) of the alternative banking institutions that responded to the survey defined themselves as micro-businesses. Only 10% of alternative banking institutions described themselves as large, and 8% as extremely large. The remaining institutions were categorised as small (20%) and medium (12%).

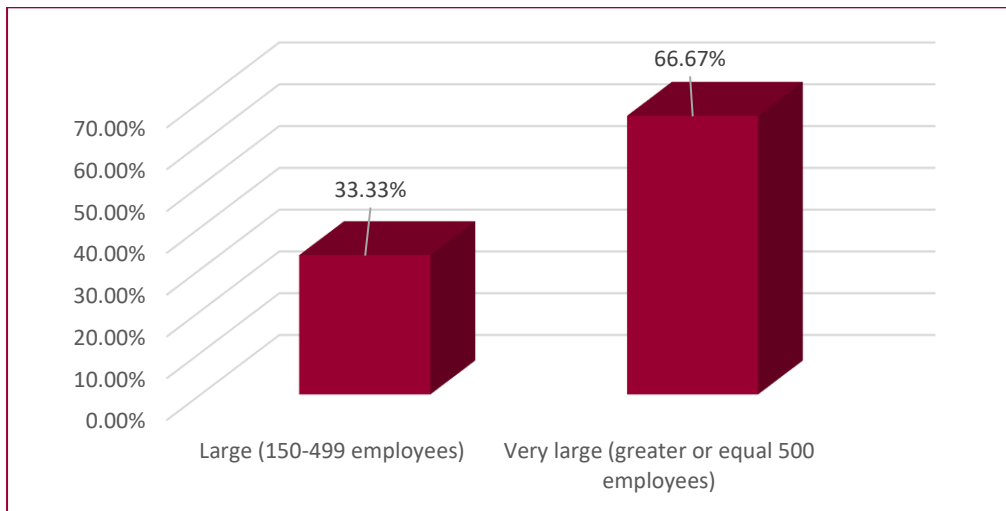
Figure 10: Alternative Banking Institutions Classified by Size



Source: BANKSETA Survey, 2023

In the traditional banking sector, the majority (66.67 percent) of individuals who replied to the study defined themselves as very large, while the remainder (33.33 percent) classified themselves as large.

Figure 11: Traditional Banking Institutions Classified by Size



Source: BANKSETA Survey, 2023