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Working Paper DG-002

AFRICAN ECONOMIC RESEARCH CONSORTIUM
CONSORTIUM POUR LA RECHERCHE ÉCONOMIQUE EN AFRIQUE

Bringing Rigour and Evidence to Economic Policy Making in Africa

A Value Chain Approach to Data Production, Use and Governance for Sound Policy Making in Africa

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AERC Working Paper DG-002
African Economic Research Consortium, Nairobi
February 2023

THIS RESEARCH STUDY was supported by a grant from the African Economic Research Consortium. The findings, opinions and recommendations are those of the author, however, and do not necessarily reflect the views of the Consortium, its individual members or the AERC Secretariat.

Published by: The African Economic Research Consortium
P.O. Box 62882 - City Square
Nairobi 00200, Kenya

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Abstract

The purpose of this research was to investigate the value chain approach to data production in Africa and how it can be improved to enable sound policy making in the continent. The research also explored ways of increasing uptake of official statistics for informing decision-making in policy formulation and other aspects such as social environmental issues. The need for this research stems from the fact that Africa has in general lagged other continents in developmental matters and by extension improvement of living standards for its people. The research reviewed existing literature and identified and examined gaps and challenges regarding production and use of official statistics in Africa. Data governance gaps and weaknesses in Africa were also examined. The research also conducted three case studies covering Australian Bureau of Statistics, National Institute of Statistics of Rwanda, and Statistics South Africa where their practices regarding data production, use and governance were reviewed. Value chain analysis was conducted based on the gaps, challenges and case studies, and recommendations made regarding data production, use and governance in Africa. The research has made recommendations that need to be implemented by African countries in pursuit of sound policy making for better economies of their citizens.

Keywords: *Production and use of official statistics, data quality, value chain, GSBPM, National Statistical System, data governance, policy making*

1. Introduction

Myriad of challenges have been cited as the reasons behind under-development in Africa. Some of the most commonly identified challenges that have been linked to slow development in the continent include bad political leadership, poor corporate governance, insufficient capital, low infrastructure development, corruption, slow uptake of technology and low intra-African trade. Moreover, the level of implementation of governments' strategies and programmes have largely been rated poorly, and are strongly linked to poor performance of many economies in Africa. Many of the African countries' official statistics have also been enjoined in the blame for being shallow in coverage and failure to correctly reflect the actual situation. Consequently, official statistics have largely been viewed as of low quality, low precision, untimely, incomplete, of poor accessibility and inconsistent. The statistics from most of the African countries are therefore regarded with mistrust and occasionally judged as insufficient in informing development needs for the continent.

Considering the necessity for accelerating development in Africa, there is need to strengthen the state of official statistics. Quality and reliable data are required to inform policy formulation at country level and to monitor and evaluate progress towards internationally agreed programmes such as the African Union Agenda 2063 and the United Nations Sustainable Development Goals (SDGs), among many others. It is, therefore, imperative to re-look at the way statistics are produced in Africa, with a view to addressing their quality, efficiency and effectiveness of the production process. Globally, many countries have enhanced the use of alternative data sources with the aim of cutting down on costs of production and improving on timeliness. Granted, many African countries have made efforts along similar lines and positive results are evident, but many impediments still exist. This research recommends the need for National Statistical Offices (NSOs) to encompass value chain approach to data production, heighten the uptake of statistics for evidence-based decision-making, and better governance of statistical processes to address data quality for sound policy making in Africa.

According to Porter (1985), value chain is a sequence of activities undertaken by a firm or an organization to create a product or service. A firm or an organization performs a number of discrete activities in production of a good or service, starting from designing a product or service up to delivering it to customers. The main

objective of value chain analysis is to improve efficiency of a firm in production of products or services by enabling it to deliver maximum value at the lowest possible cost.

In relation to statistics, the value chain entails the process of identifying the data needs, designing data collection instruments, testing data collection instruments, collecting the data, processing the data, analyzing the data, and disseminating the data for its final use. The data value chain also addresses uptake of data by potential users and the resultant impact of data usage. This is deemed important to evaluate if the statistics are meeting their intended purposes. The National Statistical System (NSS) in every country should ensure there is constant feedback between producers, users and other stakeholders for perpetual improvement of quality of official statistics. According to the European Commission, Statistics Sweden and Eurostat (1999), quality statistics are defined as those statistics that are accurate, relevant, consistence, comparable, timely, reliable, complete, impartial, and accessible to all users.

Reviewing data value chain also calls for addressing inherent data governance weaknesses that have persistently undermined the development of official statistics to requisite standards in Africa in accordance with best international practice. In this respect, the research made recommendations on practical ways of managing the quality, availability, integrity, validity, interpretability, consistency and accessibility of statistics to enhance trustworthy uptake of official statistics in Africa.

2. Methodology

The research mainly reviewed existing literature to identify and examine gaps and challenges regarding production and use of official statistics in Africa. The governance structure in production and use of official statistics in Africa was also examined, where underlying gaps and weaknesses were identified. The research identified the current practice by African NSOs in production of official statistics, examined the uptake of official statistics produced in Africa, examined the governance structure of NSOs in Africa, and compared these practices with the best international practices. Based on these gaps, challenges and weaknesses, value chain analysis was conducted on data production, use and governance in Africa and recommendations made for future improvements.

The research also conducted three case studies on Australia, Rwanda and South Africa where their practices in relation to data production, use and governance were reviewed. The study focused on these three countries since they have excelled in specific areas regarding production and use of official statistics. These three case studies were used as a benchmark for enriching recommendations on how other African countries can improve value chain in production of official statistics, utilization of these statistics and data governance. The case studies targeted areas on quality dimensions, efficiency in production process, effectiveness of NSS, use of alternative data sources (e.g. Big data and citizen-generated data), and dissemination of official statistics.

3. Production and fissemination of official statistics in Africa

According to United Nations (2021) Handbook on Management and Organization of National Statistical System, official statistics are defined as statistics that are developed, produced and disseminated by countries' national statistical systems in conformity with the United Nations Fundamental Principle of Official Statistics (UNFPOS), globally agreed statistical standards, codes and recommendations and relevant national laws and programmes. Fundamental Principles of Official Statistics comprise ten principles that provide the basic rules for production of official statistics (United Nations Economic and Social Council, 2013). The 10 principles are listed below, and countries including African countries under the United Nations should follow these principles in production and dissemination of official statistics.

Fundamental Principles of Official Statistics

Principle 1: Impartiality, relevance and equal access	Principle 6: Confidentiality
Principle 2: Professional standards, scientific principles and professional ethics	Principle 7: Legislation
Principle 3: Transparency and accountability	Principle 8: National coordination
Principle 4: Prevention of misuse	Principle 9: Use of international standards
Principle 5: Sources of official statistics	Principle 10: International cooperation

Source: United Nations Economic and Social Council (2013)

Three Main Sources of Data Used in Production of Official Statistics		
1. Administrative Data Official statistics are largely based on administrative data. Administrative data is generated by government ministries, departments and agencies in the course of their administrative operations. Therefore, this secondary source of data is availed to NSOs for statistical purposes.	**2. Surveys/Censuses** Surveys and censuses are other traditional sources of data that are commonly used in production of official statistics. Surveys and censuses collect individual data directly from the population using a statistical methodology and the collected data is used solely for statistical purposes.	**3. Other Data Sources** Other data sources include commercial data streams from businesses, sensors data, geospatial data and social media data, among others (United Nations (2021).

African NSOs have been relying on traditional sources of data (administrative, surveys and censuses) to produce official statistics. According to African Data Revolution Report 2016 (UNECA et al., 2016), data revolution has led to new (non-traditional) sources of data that can be used to produce official statistics. These new sources of data include satellite data, remote sensing data, citizen-generated data and Big data, among others. United Nations (2021) p. 235 defines citizen-generated data "as data produced by non-state actors under the active consent and participation of citizens to primarily monitor, demand or drive change on issues that affect them directly." These new sources of data can be used as a secondary source for production of official statistics. Statistical surveys are relatively cheap and results can be released faster compared to censuses. However, surveys and censuses are expensive, labour-intensive and time-consuming compared to other data sources such as administrative data.

One of the major challenges faced by NSOs in Africa in using administrative data is that some sources of this data provide inaccurate, incomplete, inconsistent data resulting to low-quality data (United Nations, 2021; UNECA et al., 2016).

Main Reasons for Provision of Low-Quality Administrative Data

① Administrative data is primarily collected for administrative purposes and, therefore, **the human capital involved may not have adequate technical knowledge of producing data for statistical purposes**.

② Most African countries **do not have appropriate administrative data systems** such as civil registration and vital statistics systems for managing administrative information and **where these systems exist, they are weak**.

③ Since the data is generated mainly for administrative purposes such as for budget allocations, in some cases that **data is either over-reported or under-reported**.

④ Some government authorities or public bodies may be **reluctant to provide accurate and timely data since it may reflect negatively on their performance** in discharging their duties or delivering services to the public.

Source: United Nations (2021); PARIS21 and The Mo Ibrahim Foundation (2021) UNECA et al. (2016)

Existing evidence indicates that, in Africa, education enrolment numbers obtained from administrative sources are usually higher than those obtained from surveys. These discrepancies are mainly attributed to resource allocations to learning institutions based on the number of learners. On civil registration and vital statistics, existing evidence indicates that forty-six (46) countries in Africa have incomplete civil registration systems for registration of births and deaths. As a result, about 83% of Africans reside in a country without a well-functioning system for birth registration while 87% of deaths occur in countries without a complete system for death registration. Civil registration provides a system through which a country continuously captures and keeps complete records of births and deaths. This data is then used by policy makers for planning and monitoring provision of public goods and services on education, health, employment, social protection, housing, and electoral processes, among others. Therefore, policy decisions based on these incomplete statistics result to inadequate provision of public goods and services, thus unsatisfactory outcomes (PARIS21 and The Mo Ibrahim Foundation, 2021; UNECA et al., 2016).

There is increasing demand for timely and disaggregated statistical indicators, and despite reduction of their budgets, NSOs especially in Africa are faced with challenges of producing these indicators for monitoring global, regional and national goals (United Nations, 2021). To get these indicators, African NSOs are commonly funded by development partners to conduct surveys and censuses. For example,

between 2010 and 2014, donors' annual commitments to support statistics across African countries increased from US$ 6.5 million to US$ 26.7 million and it stood at US$ 26.0 million in 2017. Even though the indicators generated using donor-funded statistical activities provide useful official statistics, this type of arrangement may result to production of data that is not aligned with national priorities, which may lead to inconsistent and unsustainable production of data (PARIS21 and The Mo Ibrahim Foundation, 2021). The above review indicates that there exists gaps and challenges regarding basic statistical data used in production of official statistics in Africa.

Big Data



Big data is one of new sources of data that can be used in production of official statistics.

Big data is defined as data generated in **large volumes, varieties and velocity**.

It is generated through **business transactions, communication devices, phone logs, social media, sensors and web scrapping among others**.

Non-traditional sources of data such as **big data has the potential to complement, supplement or partially replace traditional sources of data** due to their high population coverage and usage in daily life.

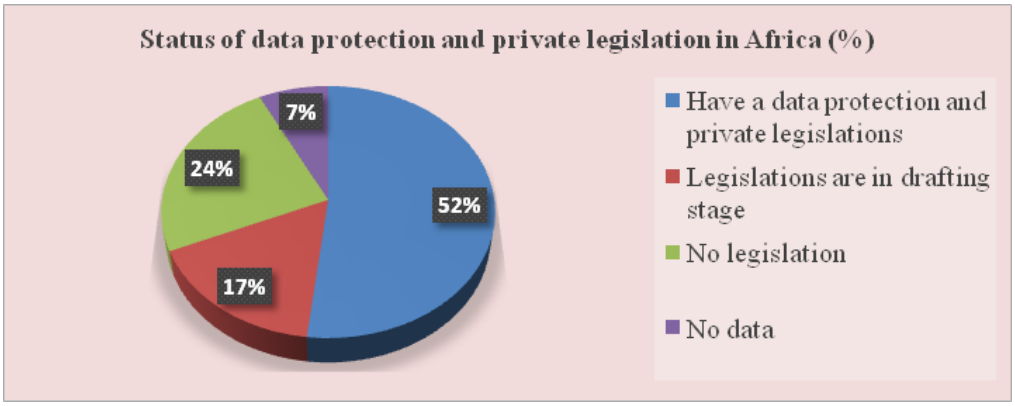
However, there is little evidence on use of big data in production of official statistics.

The technology required to process these new sources of data is available and is continuously improving; the main challenge facing NSOs is gaining access to the data and having the required technical capacity and skills to secure, process and analyze the data.

Source: United Nations (2021); UNECA et al. (2016).

A review conducted by UNCTAD in 2020 on data protection and privacy legislation across the world indicates that in Africa, 28 countries (52%) have data protection and privacy legislations, 9 countries (17%) have legislations in the drafting stage, 13 countries (24%) have no legislation, while there was no data for 4 countries (7%).

Figure 1: Status of data protection and private legislation in Africa



African countries need to enact and implement data protection laws and regulations that will ensure that data in the custody of NSOs and other organizations across NSS is treated with utmost confidentiality, in addition to putting in place strong data security mechanisms that protect data in their custody against ever evolving digital attacks (cyber-attacks).

To guide countries on use of Big data in production of official statistics, the United Nations Statistical Commission established a Global Working Group on Big Data for Official Statistics. The group has created a Global Platform through which countries can gain access to Big data held by multinational corporations and modern methods used in processing and analyzing this type of data. In addition, this platform creates an environment for capacity development activities in new areas, which include privacy-preserving methods, artificial intelligence, data science and machine learning statistics (United Nations Statistical Commission, 2020).

During the Kigali Declaration of 2019, it was agreed that through the Global Platform, all countries under the United Nations should be provided with the required technological infrastructure for processing and analyzing Big data, and emphasis was made on the need to support developing countries for them to access global datasets, modern technologies and services. Rwanda is one of the African countries that is set to host the regional hub on Big data, which in collaboration with regional and international agencies will support capacity building for African countries, to enable them utilize Big data in production of official statistics (United Nations Statistical Commission, 2020).

In Africa, the Big data community is relatively small, but it is rapidly growing. African NSOs can access existing technological infrastructure (hardware and software) required to process huge datasets; however, there are two main challenges. First is getting financial resources to acquire the required technology and second is getting the human capacities and skills required to process and analyze the data. To benefit from non-traditional data sources, African countries need to address issues limiting access, invest in modern technology, and recruit and retain staff with technical skills.

Enacting legislation that protects personal data and guarantees data privacy will enable African countries to gain access and benefit from Big data and other non-traditional data sources (PARIS21 and The Mo Ibrahim Foundation, 2021; UNECA et al., 2016).

These new sources of data, especially big data, require new techniques and methods to extract and generate statistical indicators that may be used as official statistics. Data from these new sources is not mainly generated for production of official statistics; therefore, data and statistical indicators generated from these sources need to be validated using new methodological techniques for them to be used as official statistics. This requires new skills sets. Research indicates that African NSOs are characterized by under-staffing, low-skilled workforce and high staff turnover. This affects the quality of statistics produced (United Nations, 2021; PARIS21 and The Mo Ibrahim Foundation, 2021; UNECA et al., 2016).

African NSOs need to establish partnerships with Big data sources, ICT agencies, data protection agencies, monitoring and evaluation agencies, data engineers, data scientists, data miners and data analysts, among others, which will facilitate continuous interactions in relation to use of new (non-traditional) data sources in production of official statistics. For example, the International Telecommunication Union (ITU) in collaboration with the Communication Authority of Kenya, Kenya National Bureau of Statistics, Mobile Network Operators and Internet Service Providers conducted a pilot study on measuring information society using Big data. The pilot study found that Big data has the capability to provide quality data that can be used for policy making. Issues of confidentiality and data formats are some of the challenges that were experienced during the study (ITU, 2016).

4. Value chain theory in data production, use and governance

Value chain as explained earlier is a stream of activities that are performed by firms or organizations to create a product or service. According to Porter (1985), value activities are classified into two broad components: primary activities and support activities. Primary activities are the activities directly undertaken by a firm in creation of a product or service and are broadly divided into five categories: inbound logistics, operations, outbound logistics, marketing and sales, and service. Support activities are broadly divided into four categories: procurement, technology development, human resource management, and firm infrastructure.

The general value of official statistics is that first, they provide an indispensable component in the information system of a democratic society. They serve the government, economy and the public with data on the economic, demographic, social and environmental situation. Official statistics enable decision-makers either in government or in the private sector, including the public, to make decisions based on high quality information, which leads to better outcomes. Secondly, quality official statistics provide an avenue for citizens to hold government and private organizations to account, thus enhancing transparency and accountability. Thirdly, researchers use official statistics as a complete source of evidence to do research and analysis, which leads to innovation and improved socio-economic outcomes (United Nations, 2021; UNECE, 2018).

Statistics are not solely produced by NSOs within the National Statistical Systems; there exists other organizations both private and public that are outside the official statistics system that produce statistics. However, official statistics have a comparative advantage since they are generated scientifically based on international standards and methods, and quality criteria provided for in the United Nations Fundamental Principles of Official Statistics, which then guarantees professional independence. A cost-benefit analysis of official statistics conducted in developed countries such as United States, Australia, New Zealand and United Kingdom indicate that the benefits of official statistics outweigh the cost of their production in that they are cheap and are efficient in utilization of resources (United Nations, 2021; UNECE, 2018). This indicates that countries can deliver maximum value of official statistics at the lowest possible cost.

Value Chain Analysis in Official Statistics It involves examination of a stream of primary activities and support activities by an NSOs in data production.	
Primary Activities	**Support Activities**
Identification of data needs Designing and testing data collection instruments Data collection, processing, analysis and dissemination Use of official statistics	Financial and human resources Statistical capacity Procurement processes Technologies used in production of official statistics Governance structure of NSOs; comprise of support activities undertaken to guide and oversee the implementation of statistical activities.

Source: United Nations (2021); National Institute of Statistics of Rwanda (2019); Statistics Botswana (2015)

5. Value chain approach to production and dissemination of official statistics in Africa

This section reviews the value chain approach to production and dissemination of official statistics in Africa, where both the demand and supply sides of official statistics is discussed. The demand side involves the identification of data needs for different users and obtaining their feedback regarding use of official statistics. The supply side involves data collection, processing, analyzing and dissemination. The use of official statistics by different users and data governance are also discussed. The value chain analysis of statistical activities in Africa has been examined using both Porter's Value Chain Model and Generic Statistical Business Process Model (GSBPM).

The GSBPM provides a sequence of all necessary activities and steps that need to be undertaken in production of statistics (UNECE, 2019), and these activities constitute primary activities under the Porter's Value Chain Model. However, an organization requires financial resources, legal framework, leadership, human capital and suitable technology, among others, to carry out all the necessary activities under GSBPM. These resources provide support for carrying out all the necessary activities and, therefore, they constitute support activities under the Porter's Value Chain Model. Figure 2 below presents Level 1 and Level 2 of the GSBPM.

Identification of data needs for different users

Production and dissemination of official statistics should be based on users' demand for the statistics. Producers of official statistics, more so National Statistical Offices, should plan and implement their statistical activities that satisfy needs of different users. This means that NSOs should carry out demand-driven statistical activities. Users of official statistics include: national and regional governments (policy makers, lawmakers, civil servants across different government offices); international and regional organizations; businesses; media; academic, research and education community; non-government organizations (NGOs); and the public (United Nations, 2021).

Identification of data needs for different users is the first key activity in the data value chain. At this level, NSOs should engage different users of official statistics and identify their data needs, and this should form the basis of their statistical programmes and activities.

The establishment of systems for the identification of data needs for different users is still very low among African NSOs. For example, the Kenya NSO noted that one of

the challenges it faced in implementation of the 2013-2017 strategic plan was on how to synchronize the collection and compilation of data with the interests of various stakeholders (Kenya National Bureau of Statistics, 2018). To overcome this challenge, the NSO noted that during implementation of the 2018-2022 strategic plan, it needs to undertake an analysis of data users' needs and align production and management of statistical activities with user requirements. In addition, the NSO noted that adequate engagement of stakeholders in planning and implementation of statistical operations is important for identification of their requirements and enhancing ownership and acceptance of results.

Figure 2: The phases (level 1) and sub-processes (level 2) of the GSBPM

Overarching Processes							
Specify Needs	Design	Build	Collect	Process	Analyze	Disseminate	Evaluate
1.1 Identify needs	2.1 Design outputs	3.1 Reuse or build collection instruments	4.1 Create frame and select sample	5.1 Integrate data	6.1 Prepare draft outputs	7.1 Update output systems	8.1 Gather evaluation inputs
1.2 Consult and confirm needs	2.2 Design variable descriptions	3.2 Reuse or build processing and analysis components	4.2 Set up collection	5.2 Classify and code	6.2 Validate outputs	7.2 Produce dissemination products	8.2 Conduct evaluation
1.3 Establish output objectives	2.3 Design collection	3.3 Reuse or build dissemination components	4.3 Run collection	5.3 Review and validate	6.3 Interpret and explain outputs	7.3 Manage release of dissemination products	8.3 Agree an action plan
1.4 Identify concepts	2.4 Design frame and sample	3.4 Configure workflows	4.4 Finalize collection	5.4 Edit and impute	6.4 Apply disclosure control	7.4 Promote dissemination products	
1.5 Check data availability	2.5 Design processing and analysis	3.5 Test production systems		5.5 Derive new variables and units	6.5 Finalize outputs	7.5 Manage user support	
1.6 Prepare and submit business case	2.6 Design production systems and workflow	3.6 Test statistical business process		5.6 Calculate weights			
		3.7 Finalize production systems		5.7 Calculate aggregates			
				5.8 Finalize data files			

Source: UNECE (2019)

The South Africa NSO in its strategic plan 2020/21-2024/25 notes that there are new demands for statistics, such as statistics on the digital economy, well-being and climate change. These new demands have led to diverse data requirements and changed the structure of data users. Traditional sources could not meet these new demands. The agency, therefore, noted that to meet these new demands it needs to

conduct in-depth data analysis by integrating data from different sources, seeking collaborations with other data producers in the analysis of existing data, and exploring the use of alternative sources of data (Statistics South Africa, 2020).

The Ghana NSO in its strategic plan for 2020-2024 indicates that it will conduct an assessment survey and hold focus group discussions to identify statistical needs for stakeholders in the private sector (Ghana Statistical Service, 2020). The Rwanda NSO, on the other hand, conducts biennial User Satisfaction Surveys (USS) that collect feedback on preferences of different users of official statistics. These surveys provide important feedback that helps the statistical agency in planning and implementing data production activities (National Institute of Statistics of Rwanda, 2019).

These examples show that only a few countries in Africa have created mechanisms of ensuring continuous interaction of data users and producers of official statistics with an aim of enhancing the production of official statistics that meet user requirements and increasing the demand and uptake of official statistics. African NSOs need to appreciate that the process of identifying data needs for different users should be part of their routine activities. Identification of data users' needs referred as specify needs phase in the GSBPM is the first phase of the eight phases identified in the overall production of official statistics as shown in Figure 2 (United Nations, 2021; United Nations Economic Commission for Europe - UNECE, 2019). The choice of source(s) of data to be used by an NSO should be based on its ability to meet the required statistical standards and data users' needs at the lowest cost possible.

Designing data production processes

Once the needs of different users are identified, the next step is the design phase under GSBPM as shown in Figure 2, where NSOs are required to define the required statistical outputs that need to be produced, define variables to be collected, determine the most suitable data collection tools and methodologies, and develop and define all the data production operational processes (United Nations, 2021; United Nations Economic Commission for Europe, 2019).

National statistical agencies in Africa are usually faced with challenges while designing processes of data production to meet the needs of different users. First, data gaps in Africa are a common phenomenon especially on civil registration and vital statistics (registration of births and deaths, migrants' records), health, poverty levels, agriculture, climate change and digital economy, among others (PARIS21 and The Mo Ibrahim Foundation, 2021; UNECA et al., 2016). Some of these data gaps arise from weak administrative data systems, lack of these systems altogether, or delays/failure to conduct various surveys/censuses. Due to data gaps, some data users such as private sector, civil society organizations, academia and other non-state actors' resort to independent production of statistical information for use in their operations. This is a positive outcome arising from data gaps and, therefore, statistical agencies should work together with other data producers to supplement official statistics. This

can be achieved by establishing partnerships between NSOs and non-state actors' data producers, which will ensure that these actors produce data using internationally accepted standards and methods.

Surveys provide an alternative source of data in cases where administrative data is missing or incomplete. This is a common phenomenon in Africa, and NSOs use surveys/censuses to obtain data that can be generated from administrative data such as data on births, deaths and health. Therefore, to fill the data gaps, these countries resort to conducting surveys to supplement and complement data from administrative sources. This increases surveys sample sizes and number of survey/census questions, thereby increasing the cost of surveys/censuses, which negatively affects the quality of the data collected mainly due to respondents' fatigue and misreporting by fieldwork staff.

For example, first, population and housing censuses conducted in Malawi and Kenya in 2018 and 2019 (Government of Malawi, 2019; Kenya National Bureau of Statistics, 2019), respectively, had several questions covering different thematic areas, namely: demographic (age, sex, relationship, marriage, fertility, mortality, disability); socio-economic (marital status, religion, ethnicity, education, labour participation, ICT, agriculture); and household and housing characteristics (floor/roof/wall materials, tenure status, dwelling units, sources of water, energy and waste disposal). The United States of America 2020 Census had only nine questions covering the following thematic areas: demographic (age, sex, relationship); socio-economic (ethnicity, race mobile phone ownership); and household and housing characteristics (tenure status).

Second, most African countries develop their household sampling frames based on the previous population and housing censuses. In the 2010 round of population and housing censuses, only 47 African countries conducted censuses while in the 2020 round of censuses (2015-2024), as at September 2020, only 11 African countries had conducted their censuses (Bruno et al., 2020; UNECA, 2020). Some African countries were set to conduct their censuses in 2020, but they postponed the exercise to 2021 and 2022 due to COVID-19 pandemic, where finances initially allocated to census activities were diverted to address the pandemic (UNECA, 2020; United Nations Statistics Division, 2020). Therefore, household sampling frames currently being used in Africa are mainly based on the 2010 round of population and housing censuses, implying that the samples drawn from these frames may not be representative of the entire population.

Third, African countries use different methods and standards in production of statistics, which makes it difficult to compare data from different countries. This challenge arises from use of different methodologies in various statistical activities, use of different concepts and definitions, and weak data technology and related infrastructure (UNECA et al., 2017). This challenge is recognized under the Strategy for the Harmonization of Statistics in Africa 2017-2026 (SHaSA 2), where African countries aim at transforming existing statistics to make them comparable across countries, and harmonizing the methods and standards used in data production (African Union Commission et al., 2017).

As outlined in the Fundamental Principles of Official Statistics and African Charter on Statistics, national statistical agencies across Africa should coordinate the national statistical system to achieve an efficient and consistent statistical system and ensure quality and comparable statistical information (United Nations Economic and Social Council, 2013; African Union Commission, 2009). The coordination role of African NSOs should be anchored in law to enable them play a key role in nurturing partnership, harmonization and coordination of the national statistical system (UNECA et al., 2016). In Africa, the capacity of national statistical agencies to coordinate NSS is inadequate, which leads to low statistical capacity across NSS.

African countries need to strengthen coordination capacity of NSOs to improve quality of official statistics and reduce the cost of producing data in Africa by taking advantage of data produced by other data producers to fill existing data gaps (PARIS21 and The Mo Ibrahim Foundation, 2021). This will in turn reduce the number of questions in surveys/censuses, thus reducing the cost of carrying out surveys/censuses and improving the quality of the data collected. In addition, use of reliable administrative data will result to timely production of statistical indicators for use by policy makers and other users, which will then generate better outcomes for the society.

Development and testing of data collection instruments and other key processes

Once data production processes have been designed, the next phase in production of official statistics is the development and testing of the data collection instruments, and development and testing of data processing, analysis and dissemination processes. Other technical processes, logistics and administrative arrangements related to production of the required statistical information are also developed and tested in this phase. This phase is referred to as the build phase under the GSBPM as shown in Figure 2. This phase in production of statistics is carried out once or when there is change in technology or methodology for regularly generated statistical outputs (United Nations, 2021; UNECE, 2019).

Most African countries have embraced the use of Information and Communication Technology (ICT) in production of official statistics. This is evidenced by the adoption of Computer Assisted Personal Interview (CAPI) technology in data collection and transmission by a number of countries in Africa. Use of CAPI technology and other modern mobile technologies in data collection and processing improves the quality of data and reduces the time taken to collect data, process, analyze and disseminate the data. The main challenge for adopting CAPI technology in production of statistics is the cost of the equipment and ICT infrastructure required (United Nations, 2021; Kenya National Bureau of Statistics, 2019; Kenya National Bureau of Statistics, 2018). Malawi and Kenya are examples of two African countries that conducted their population and housing censuses in 2018 and 2019, respectively, using CAPI technology. This

enabled these countries to release their first population and housing census report in a record of three months after census enumeration for Malawi and two months after census enumeration for Kenya (Government of Malawi, 2019; Kenya National Bureau of Statistics, 2019). In 2017, about 57% of African countries had decided to use CAPI in their census taken during the 2020 round of population and housing censuses (Bruno et al., 2020).

The challenges facing African countries regarding use of modern technologies in production of official statistics includes: inadequate finances, inadequate human capital, inadequate technical skills, inadequate technical capacity, and poor mobile network coverage that affects data transmission, among others (PARIS21 and The Mo Ibrahim Foundation, 2021; UNECA et al, 2016). CAPI data collection tools and related ICT infrastructure need to be tested severally and piloted before they are deployed for main data collection. Due to the challenges mentioned above, African national statistical agencies experience difficulties in testing and piloting CAPI data collection tools and related ICT infrastructure.

For example, Bruno et al. (2020) notes that a number African countries require external support in mobilization of required financial resources and technical assistance to strengthen their capacity to adopt modern technologies for them to conduct CAPI censuses in the 2020 round of population and housing censuses. In addition to the 2020 round of censuses, other statistical activities in Africa have also been negatively affected by the COVID-19 pandemic due to disruptions of work arrangements and data collection activities (United Nations Statistics Division and World Bank, 2020).

African countries have not standardized data collection tools due to use of silo approach in production of official statistics across NSS. Silo approach in data ecosystems may lead to duplication of efforts and data errors, thus limiting data systems interoperability and interrupting linkages across different statistical processes (United Nations, 2021; National Institute of Statistics of Rwanda, 2019).

African NSOs need to leverage their adoption of modern technologies in production of statistical information to develop and adopt an integrated data production system, where processes for different statistical activities are standardized and linked through development and application of similar standards, methods and modern technologies. This will achieve efficiency in production of official statistics by use of standardized data collection and processing tools, lower the costs of conducting statistical activities such as surveys and censuses, and reduce the time taken to produce statistical outputs. This system will enhance efficient and better use of available resources (United Nations, 2021).

Organizations across African Statistical Systems need to collaborate among themselves to improve production and use of statistical information in Africa (United Nations Economic and Social Council, 2013; African Union Commission, 2009). One of the main objectives of SHaSA 2 is to improve statistical coordination and collaboration among international partners, regional organizations, continental organizations, and national statistical institutes (African Union Commission et al., 2017). This will enable

African countries to utilize available resources more efficiently. For example, Kenya is supporting African countries with mobile devices (locally assembled and used in the 2019 census) and technical capacity for their respective census undertaking (Republic of Kenya, 2021).

On funding of statistical activities in Africa, a study reviewing financing of national statistical systems in Rwanda, Ethiopia and Philippines highlighted the following factors as crucial in establishment of a well-funded statistical systems. The first factor is increase in demand for statistics required to monitor and evaluate both national and international priorities. This has helped NSOs in these countries to get sufficient and sustainable funding from both national budgets and development partners. Second, there is high level of political interest and support for statistics in these three countries, which has enabled governments to manage relations with donors and efficiently implement development plans. Third, donors in these countries have aligned their financial and technical support for statistics with government strategies. Fourth, the legal framework governing operations of NSOs in these three countries has enabled them to operate independently, thus increasing the trust of statistics produced. The fifth factor is the alignment of the National Strategies for Development of Statistics with country development plans, and the last factor is the coordination of statistical stakeholders within NSS (PARIS21, 2018).

Data collection, processing and analysis

Data collection involves collecting information from different sources with an aim of meeting the needs of different users. The collected data is thereafter processed and analyzed to produce required statistical indicators. These are three phases: collect phase, process phase and analysis phase under the GSBPM as shown in Figure 2. Under collect phase, all the necessary information is collected to meet the identified user needs. This phase also comprises all preparatory activities aimed at ensuring that people, processes and technology are ready to collect the required statistical information. These preparatory activities include: sample creation and selection, training of data collection personnel, procurement and provision of required data collection instruments, publicity and advocacy to inform respondents about the statistical activities, close supervision and coordination of data collection personnel to minimize non-responses and errors, and data transmission, storage and retrieval for analysis (United Nations, 2021; UNECE, 2019).

African NSOs face a number of challenges while collecting data for production of official statistics. Some of these challenges are similar to the challenges affecting other data production processes as mentioned earlier, such as inadequate funding, over-reliance on donor funding, data gaps, low usage of alternative data sources, inadequate coordination of NSS, understaffing and inadequate human capital skills and capacity especially in modern ICT environment, insufficient update of administrative data collection instruments and unautomated administrative data systems.

Other challenges as noted in the Kenya National Bureau of Statistics 2018-2022 Strategic Plan, Statistics South Africa Strategic Plan 2020/2021-2024/2025, Statistics Botswana Strategic Plan 2015-2020 and Namibia Statistics Agency Strategic Plan 2017/18-2021/22 include: delay in disbursement of allocated funds from the exchequer, delay in procurement of required products and services, delays/failure to update sampling frames, limited sample sizes that do not allow disaggregation of data to the lowest levels possible, low surveys/censuses response rates, difficulties in accessing some clusters in high-end residential areas and conflict prone areas, and lack of an elaborate long-term plan indicating timelines for conducting different surveys and censuses.

The process phase involves processing of the collected data and preparing it for analysis while under the analyze phase, statistical outputs are generated and validated before they are disseminated. The process and analyze phases are usually done concurrently. Processing and analyzing data in Africa face similar challenges as those outlined in data collection phase.

In addition, some African countries are experiencing challenges in computation of Gross Domestic Product (GDP) growth rates and poverty estimates, whereby the statistical foundations used to compute these statistical indicators are very weak. Computation of GDP in some African countries is done using old methods, and there is lack of frequent poverty estimates in most African countries and those available are not comparable across time and space (Devarajan, 2013). For example, a survey conducted by United Nations Economic Commission for Africa in September 2020 showed that 30 African countries (55.6%) were using the 2008 System of National Accounts (2008 SNA) to compute GDP, 22 countries (40.7%) were using the 1993 SNA, one country (Sudan) was using 1968 SNA while there was no information for Libya (UNECA, 2020). In addition to the above challenges, there is fragmentation of statistical activities in Africa especially in surveys, whereby two or more statistical activities on one topic are conducted by different organizations. These statistical activities are usually conducted using different methods, thus making it difficult to compare the outputs across time and space (Devarajan, 2013).

Adoption of Global Statistical Geospatial Framework, which facilitates the integration of geospatial and statistical information will enable statistical agencies to analyze data up to the lowest level possible (United Nations Statistical Commission, 2019). The framework enables integration of different datasets from geospatial and statistical communities, which allows generation of standardized and harmonized geospatially enabled statistical information.

Dissemination and use of official statistics

This is dissemination phase under GSBPM, where statistical outputs are released to users using different channels. Once the production of official statistics is complete, these statistics and related statistical information such as metadata and

methodologies used need to be made available, accessible and understandable by all types of users. Dissemination and use of statistics that provide better understanding and better decision-making in relation to the economy and society in general should be considered as the core objective of national statistical systems. Statistical agencies should provide support to all data users by responding to requests for additional data and information and also responding to queries in regard to the released statistical outputs (United Nations, 2021; UNECE, 2019).

Accessibility and use of official statistics are challenges to several African countries due to the following difficulties that also affect other data production processes mentioned earlier: weak data technology, weak infrastructure, political issues, inadequate funding and inadequate capacity. These challenges limit the capability of African NSOs to disseminate official statistics through various channels, which include: national statistical agencies' websites, data portals, social media, machine to machine, hardcopy, mobile apps, Geographic Information System (GIS) portals, statistical yearbook and dynamic visualizations. Statistical outputs from surveys and censuses conducted in Africa are usually released late. This affects the usability of the data. However, use of technology in data collection in surveys and censuses in Africa is enabling timely release of statistical products that help in filling the existing data gaps (UNECA, et al., 2017).

Policy makers in Africa and the public are not adequately informed on the important role that statistical information can play in improving social and economic development of an economy. This lack of awareness on the importance of statistics in society is an impediment to development and use of statistics in Africa, and it negatively affects the quality and availability of statistical information.

Making official statistics available and accessible to all users increases the possibility of these statistics being used in decision-making by public officials and civil servants; enhances transparency and accountability in government operations; and improves delivery of services to the public and this leads to better socio-economic outcomes in the society. In addition, availability and accessibility of official statistics fosters innovation and economic development, where businesses use these statistics to gain a better understanding of different market segments and based on these statistics, they develop new goods and services (PARIS21 and The Mo Ibrahim Foundation, 2021; UNECA et al., 2016).

Data openness by NSOs provides information on available data, reduces duplication across NSS, reduces the data production cost, and enables users to identify data gaps that inform data production activities. Data openness in Africa is still very low; for example, in 2018, data openness score was 12 points below the world average. In addition, African NSOs experience challenges in providing data in user-friendly formats. A review conducted by Open Data Watch in 2018 shows that out of the data published on 49 African NSOs websites, 69.5% of the data was in non-proprietary format, 39.7% of the data and its metadata was available, 29.4% had download options, 18.5% of the data was machine-readable, and 12.9% of data had terms of use (PARIS21 and The Mo Ibrahim Foundation, 2021; UNECA et al., 2016).

Engagement of data users by NSOs in Africa should be one of their core activities, and this can be achieved by developing a user engagement strategy. This is part of evaluate phase, the eighth phase under GSBPM. According to UNECA (2020), a user engagement strategy outlines the methods to be used to: encourage interactions among data producers and users; establish mechanisms for obtaining feedback and experiences on use of statistical products and services; and provide a framework that guarantees that data users' feedback is considered while making data production decisions.

Data Governance

Data governance in production of official statistics refers to those support activities undertaken by national statistical offices to guide and oversee the implementation of statistical activities. These support activities entail the legal frameworks governing the production of official statistics, institutional frameworks of NSOs and other institutions within NSS, financing frameworks and overall management of NSOs (United Nations, 2021; National Institute of Statistics of Rwanda, 2019; Statistics Botswana, 2015). The overall management of NSOs comprises the following activities: general management, human resources management, financial management, supply chain management, management of organizations' assets including ICT equipment, and quality management (Statistics Botswana, 2015; Porter, 1985).

Data governance functions are categorized into four clusters; first cluster is strategic planning, which involves development of strategies and establishment of institutional arrangements. The second cluster is making and implementing rules and it entails making legislation and regulations, setting standards and offering clarification and guidance. The third cluster is compliance, which comprises enforcing, auditing, arbitrating, and remedying. Enforcing is done daily to ensure compliance with the established legal framework, standards and norms. The fourth cluster is learning and evidence and it comprises monitoring and evaluation and risk management. This function enables an organization to assess its performance and that of its staff and evaluate the achievement of the project(s) objectives (World Bank, 2021).

The laws and regulations governing statistical agencies and national statistical systems significantly determine the quality of official statistics produced, their availability, accessibility and use. The laws and regulations governing NSS in Africa should enable NSOs to produce accurate, relevant, consistent, comparable, timely, reliable, complete, impartial and accessible data as per the Fundamental Principles of Official Statistics, and the African Charter on Statistics. African NSOs should be autonomous to enable them produce official statistics without any interference, especially political interference. Some of the challenges facing African NSS especially NSOs is lack of political and institutional independence, which has weakened the managerial and technical ability of some NSOs to work effectively. For example, out of 54 African countries, only 12 National Statistical Offices in Africa are considered to be autonomous (UNECA, et al., 2017).

Another example is that during the 1990 round of population and housing censuses, Kenyan census results were subjected to political ridicule while those from Nigeria were accepted after eight years. In addition, in some African countries, data on population, education and agriculture is commonly politicized since it is mainly used for delineation of political boundaries and resource allocations. Therefore, legal frameworks governing operations of NSOs in Africa should allow these offices to operate independently and should be anchored on the Fundamental Principles of Official Statistics, and the African Charter on Statistics. This will improve the quality, credibility and trust in official statistics since these offices are able to ensure that there is professional independence, impartiality, and application of international standards and scientific methods in production of official statistics. The autonomy of African NSOs is not enough and should be coupled with provision of adequate human and financial resources (UNECA et al., 2016).

Evidence shows that legal autonomy enhances the trustworthiness of NSOs, thus enabling them to attract and sustain funding from both domestic sources and development partners. Rwanda, Ethiopia and the Philippines are examples of countries that have been able to attract and sustain funding for statistical activities since the existing legal framework has enabled the NSOs to operate independently (PARIS21, 2018).

Institutional frameworks entail institutions within NSS, which includes government ministries, departments and agencies. There are a number of organizations within NSS and these organizations operate under different mandates and there are variations in their financing and capability (National Institute of Statistics of Rwanda, 2019). Coordination of NSS is, therefore, essential in ensuring that these institutions supply required data for production of official statistics. In Africa, the capacity of NSOs to coordinate NSS is insufficient, which negatively affects the supply of data for production of official statistics.

Succession planning and management across NSOs in Africa is weak, and this negatively affects the production of official statistics. Experienced employees including managers exit the service frequently, thus affecting the management and operations of NSOs. African NSOs should, therefore, develop and implement a succession strategy. Another challenge is that some African NSOs do not have adequate office space and the work environment is unfavourable (Kenya National Bureau of Statistics, 2018).

African NSOs should develop strategic plans and national statistical development strategies to guide the implementation of statistical activities and other support activities. As indicated earlier, African countries that have developed strategic plans usually face obstacles that hinder full implementation of the plans, which negatively affects the timelines of these activities. Quality management is another key element that NSOs should embrace, since it ensures production of quality data that meet the needs of different users. Development and implementation of Data Quality Assurance Framework (DQAF) is one of the ways of managing the quality of data produced by NSOs. Some African NSOs do not have these data quality assurance frameworks, which makes it difficult to assess the quality of statistics produced.

6. Case studies

Case study one: Australian Bureau of Statistics

The Australian Bureau of Statistics (ABS) is established as an independent statutory authority under Australian laws. It is mandated to collect statistical information on a wide range of economic, demographic, social and environmental topics and contains solid provisions for maintaining confidentiality of collected information (Australian Bureau of Statistics, 2019). ABS has been producing and providing high quality statistics to all users, including governments, the public and researchers and these statistics influence key decisions. ABS has been receiving adequate funding from the government, which has enabled the institution to carry out its functions effectively and efficiently (Telford, Araghi and Samson, 2017). ABS generates independent statistics and upholds the highest standards of confidentiality, and the statistical information produced by the NSO are trusted by majority of users. ABS is impartial, exercises professionalism in its work and it is transparent and accountable to the Australian community (Telford, Araghi and Samson, 2017).

ABS uses alternative sources of data in production of official statistics, and only conducts surveys when necessary to improve the quality of its statistical products (Australian Bureau of Statistics, 2019). In its website, ABS has a monthly release calendar that indicates the expected release dates of various statistical products in the next six months. Furthermore, the released statistical products are uploaded on the ABS website and are easily accessible. The NSO has established an online user engagement platform, the consultation hub that is domiciled in its website. The consultation hub enables data users to provide feedback on the use of ABS statistical products and services (Australian Bureau of Statistics, 2021).

The NSO has a workforce strategy which aims at increasing its capacity and ability; identifying, monitoring, and forecasting where knowledge and skills are needed; and supporting innovative methods of working to achieve high performance and efficiency. ABS is improving its capability to leverage non-traditional data sources, especially Big data and utilize artificial intelligence methodologies in production of official statistics. ABS uses both international and domestic standards, frameworks and classifications, which ensures production of high quality, consistent and reliable statistics (Australian Bureau of Statistics, 2019). A study conducted by Howard in 2018 indicates that ABS experiences a number of challenges, among them being reduction of its budgetary allocations, political interference and criticisms of its technical ability (Howard, 2019).

Case study two: National Institute of Statistics of Rwanda

The National Institute of Statistics of Rwanda (NISR) is an established independent institution under Rwandan laws and its mandate is to be the primary producer of data in Rwanda. NISR has established strong patterns of producing and disseminating data, which has improved the alignment between data demand for making policies and the supply of data. The number and frequency of official statistical products produced by NISR has increased over time, and the NSO ensures it meets data users' needs. NISR ensures that its products comply with policy needs and international standards and has implemented initiatives aimed at facilitating data accessibility, strengthening partnerships and enhancing statistical capacity (National Institute of Statistics of Rwanda, 2019).

The National Institute of Statistics of Rwanda (NISR) usually conducts biennial user satisfaction surveys where feedback is collected from all users of official statistics. The last survey conducted in 2016/17 indicates that statistics produced by NISR meet users' priority requirements, an indication of increase in awareness and utilization of these statistics. The survey enables NISR to map data requirements of different users, who include decision makers, analysts, technicians, investors, journalists and citizens. Rwanda has synchronized its development plans and policies with production of official statistics. The statistical information required for monitoring and evaluating these plans is usually mapped and gaps identified (National Institute of Statistics of Rwanda, 2019).

Rwanda is commonly referred to as a model for financial statistics. Official statistical activities in Rwanda are sufficiently funded domestically, especially during the first National Strategy for the Development of Statistics. In addition, funds from development partners are managed through a multi-donor basket fund. Donors' support for statistics, both financial and technical, has been aligned to national priorities (National Institute of Statistics of Rwanda, 2019; PARIS21, 2018).

Rwanda has developed a "Data Revolution Policy" whose focus is to build capabilities of different stakeholders with an aim of equipping them with knowledge and skills needed to analyze big data. Under this policy, NISR has been carrying out a range of capacity building initiatives, particularly on rebasing of national accounts, engagement with university students and teaching staff on availability and use of NISR statistics, engagement with secondary school students on reading data, and training media personnel on statistics, among others (National Institute of Statistics of Rwanda, 2021).

Rwanda is set to establish NISR Training Centre for building the capacity of workers within NSS and it has established the African Centre of Excellence in Data Science domiciled in the University of Rwanda. Rwanda has established partnerships in Big data and is exploring this source of data for monitoring and evaluation of development programmes (National Institute of Statistics of Rwanda, 2021).

However, in 2019, official statistics produced by NISR were criticized through an article in *Financial Times* whereby since 2000, Gross Domestic Product growth rate

of over 7.0%, reduction of infant mortality rate by half, and improvement in access to education and health were doubted. Poverty statistics were also criticized, whereby the newspaper argued that between 2010 and 2014, poverty rate increased contrary to what was officially reported that poverty reduced. Political influence on official statistics and the urge to attract donor funding were singled out as some of the reasons of misreporting official data (Wilson and Blood, 2019).

In another article by Royal African Society, a comparative analysis of Rwanda's Integrated Household Living Survey conducted in 2005/06 and 2016/17 points out inconsistencies of youth population age 10-24 years. Analysis of population growth by age between these two survey periods indicate that 580,000 youth population age 10-24 were missing, and there was no explanation of whereabouts of this population (Ansoms et al., 2021).

Case study three: Statistics South Africa

Statistics South Africa (Stats SA) is a national government department established as an independent organization under South African laws. Statistician-General of Stats SA is appointed by the President and is required by the Statistics Act to exercise professional independence and impartiality while discharging his/her duties and responsibilities. The Act establishes a Statistics Council that consists of members from diverse organizations or interest groups (Statistics South Africa, 2021; Statistics South Africa, 2020).

Stats SA produces and disseminates over 250 statistical products annually and it has demonstrated its capacity to deliver key projects. The NSO has been able to achieve an average response rate of over 85% in household and establishment-based surveys, which is in accordance with international best practice. Over the years, Stats SA has adopted international standards and practices in production and dissemination of official statistics (Statistics South Africa, 2020).

Stats SA has an employees' vacancy rate of 19.2%, and 53.0% of all workers are women. The NSO continuously provides training to its workforce to enhance their skills and capability. During implementation of the 2015-2020 strategic plan, Stats SA was able to consistently achieve 80% of its target as outlined in the work plan. User satisfaction survey conducted by Stats SA showed that the department produces credible and trustworthy statistics, and several users access these statistics from its website (Statistics South Africa, 2020). Stats SA has established several initiatives such as ISIbalo Capacity Building Programme aimed at training young statisticians. The NSO uses various channels to disseminate official statistics, such as Roambi, an App that was used to disseminate 2011 census data (Statistics South Africa, 2021).

Although Stats SA has been praised internationally for production of high-quality statistics, some of its statistics has been criticized both locally and globally. For example, South Africa population census data is doubted that it exceeds that of a number of advanced countries (Van Belle, 2017). Findings of a study on use of available data to inform the COVID-19 outbreak in South Africa pointed out that the methods

used by the government to share information on the pandemic were ineffective. This was due to use of different data sharing platforms, requiring a user to navigate to get accurate data; and data provided was not in computer readable format, requiring further processing.

This negatively affects the accessibility, simplicity and readability of the shared information, which has been identified as a major concern of data shared by the South African Government. The study notes that there is need for government departments to continuously engage data users and collaborate with other organizations to produce and disseminate accurate data (Marivate and Combrink, 2020). Budgetary allocations to Stats SA have been declining, and this has been negatively affecting the NSO's operations (Price, 2021).

Discussion on the case studies

The three case studies indicate that the three NSOs are established as independent organizations; follow international standards and methods in production statistics; produce quality statistics that meet needs of different users including policy makers; disseminate official statistics through various platforms thus, making them available and accessible; engage data users through various platforms; are using or exploring use of non-traditional sources of data; have adopted use of modern technologies in data production; receive relatively adequate funding from the government; have relatively adequate human resources; and coordinates NSS. However, official statistics produced by these three NSOs has been criticized as inaccurate, inconsistent, and impartial. Despite these criticisms, it is evident that these three NSOs have adopted key value chain approach activities in data production, use and governance and, therefore, other African countries can use them as a benchmark in adopting value chain approach in their statistical operations.

7. Conclusion

Official statistics have been identified as part of the challenges linked to slow development in Africa as they are largely viewed as of low quality. There is need, therefore, to strengthen the state of official statistics in Africa by re-looking at the way these statistics are produced in Africa with an aim of informing policies and monitoring and evaluating development goals at national, regional, continental and international levels.

The study focused on the need for NSOs to encompass value chain approach in data production, increasing the uptake of statistics and improving data governance to improve the quality of official statistics for sound policy making in Africa. Review of existing literature indicated that African NSOs and respective NSSs experience a number of challenges, including weak basic statistical data systems, low use of non-traditional sources of data, lack of a comprehensive data users engagement strategy, weak coordination of the NSS, inadequate data dissemination systems, lack of a strategy to enhance uptake of official statistics, inadequate funding, inadequate human resources, and gaps in the legal framework leading to lack of autonomy, among others. Recommendations have been made with the aim of improving production and use of official statistics, and governance of official statistics processes.

Studies are normally conducted in different periods and, therefore, existing literature may not reflect the current position of the study subject. There is need, therefore, to conduct further research preferably through a survey covering all African countries where African NSOs and other organizations across NSS would be asked questions on production of official statistics, usage of official statistics and governance of official statistics processes. In addition, data users such as research institutions would be asked questions on their experiences in relation to use of official statistics.

8. Recommendations

a) Strengthening the systems used in collection and processing of administrative data

To fill the existing data gaps and satisfy their needs, data users such as private sector, civil society organizations, academia and other non-state actors resort to independent production of statistical information for use in their operations. Strengthening administrative data systems and using data from other producers will help in filling data gaps, enhance production of quality statistics and reduce duplication in production of official statistics. This can be achieved by enhancing the capacity of NSOs to coordinate the NSS, and formation of partnerships with other data producers outside NSS to supplement official statistics. Efficient and effective administrative data systems (e.g., automated) will reduce data gaps, which will then reduce sample sizes for surveys and number of variables to be collected in surveys/censuses, thus lowering the cost of data production and improving data quality. This will improve the quality of basic statistical data produced across NSS, which will lead to production of quality official statistics.

b) Use of non-traditional sources of data in production of official statistics

African NSOs need to address issues limiting access, invest in technology required to process and analyze the data, and hire and retain staff with technical capacity and skills to process, analyze and interpret the data from non-traditional sources. Specifically, African countries need to develop and implement legal frameworks that protect personal data and guarantee data privacy for them to gain access and benefit from these non-traditional data sources.

Enacted data protection laws and regulations should ensure that data obtained from all sources and in the custody of NSOs and other organizations across NSS is treated with utmost confidentiality. In addition, organizations across NSS should put in place strong data security mechanisms that protect data in their custody against ever evolving digital attacks (cyber-attacks).

African NSOs need to form partnerships with owners of Big data, such as businesses, to create an enabling environment for sharing data. In addition, NSOs in Africa need to collaborate with ICT agencies, data protection agencies, monitoring

and evaluation agencies, data scientists and data analysts, among others, to facilitate continuous interactions in relation to use of new data sources. African countries need to adequately fund their respective NSOs to enable them acquire modern technologies required to process and analyze data from non-traditional sources.

c) Identification of needs for different users and establishing a national users' engagement platform

African NSOs should strengthen the process of identifying data needs for different users, and this process should be part of their routine activities. These offices should create an engagement platform where data users, mainly policy makers across government and lawmakers are encouraged to make use of available official statistics while making decisions. The statistical agencies in Africa should develop online user engagement platforms and regularly conduct user satisfaction surveys through which all types of data users will continuously provide feedback on the usage of official statistics and their level of satisfaction. This requires NSOs to develop a national user engagement strategy, which will guide the process of engaging different data users and producers, obtaining their feedback and experiences on use of official statistical products and services and incorporating this feedback in production of official statistics.

d) Coordinating the National Statistical System and collaboration across African Statistical Systems

As outlined in the Fundamental Principles of Official Statistics, and the African Charter on Statistics, NSOs across Africa should coordinate the national statistical systems to achieve efficient and consistent statistical systems and ensure production of quality and comparable statistical information. The legal framework establishing and governing operations of African NSOs should give these offices legal authority to coordinate NSS through monitoring and evaluating the quality of data collected by different government agencies in their respective countries. Under the established legal framework, African NSOs will be mandated to ensure that there is collaboration, harmonization and coordination across NSS.

Organizations across African Statistical Systems need to collaborate among themselves to improve the production and use of statistical information, and there is need to establish peer review mechanisms. At regional level, collaboration can be achieved through Regional Economic Blocs/Communities with an aim of producing comparable statistics. African NSOs through the African Union need to establish a peer review mechanism through which periodic peer reviews of statistical processes of an NSO will be conducted by other statistical agencies.

e) Use of international standards and methods in production of official statistics

African countries should continuously update sampling frames or create new sampling frames to ensure that samples drawn are representative of the population. African NSOs should domesticate and use internationally accepted standards and methods in production of different statistics. This will improve quality and comparability of official statistics at regional, continental and international levels.

African NSOs need to leverage their adoption of modern technologies in production of statistical information to develop and adopt an integrated data production system, where processes for different statistical activities are standardized and linked through development and application of similar standards, methods and modern technologies. This will achieve efficiency in production of official statistics, lower costs and reduce the time taken to produce statistical outputs.

f) Funding of activities for production of official statistics in Africa

Funding the production of official statistics in Africa needs to be prioritized in national budgets with an aim of ensuring allocation of adequate funds for production of statistics across NSS. Donors/development partners' funding for statistical activities in Africa should be coordinated and managed centrally to ensure efficiency through a committee or multi-donor basket fund. This will ensure that statistical activities funded by donors/development partners are aligned to national priorities.

African countries' statistical requirements need to be anchored in National Strategies for Development Statistics and synchronized with national development plans and policies, and funding including that from donors needs to be directed towards these strategies. This will increase the demand for official statistics to monitor and evaluate both national and international priorities, which is key in attracting and sustaining funding of statistical activities. Legal autonomy of NSOs, political support for statistics and coordination of NSS by NSOs will also improve funding for national statistical systems in Africa.

African NSOs should develop a resource mobilization strategy and create an office purely responsible for mobilization of resources for carrying out statistical activities. The mandates of African NSOs need to be enhanced to enable them provide technical and consultancy services at a fee to increase internally generated revenues.

g) Addressing human capital skills gaps across African NSOs

African NSOs need to implement the following strategies to resolve challenges of understaffing and inadequate technical skills. First, NSOs in Africa need to hire additional employees to address shortages. New employees could include data analysts, data scientists, data engineers and data miners who have the capability to extract and process non-traditional sources of data and improve overall production

of official statistics. Second, African statistical agencies need to come up with appropriate career progression frameworks that will enable them to hire and retain young professionals, thereby reducing staff turnover. Under this strategy, NSOs should develop and implement performance management systems where performance of employees is evaluated and rewards given based on performance.

Third, development of succession strategy will enable transfer of managerial and technical skills from experienced staff to new employees and ensure smooth running of operations. Fourth, African NSOs should create knowledge management systems where employees who have undergone technical training in various fields share their knowledge and skills with other employees.

Fifth, African NSOs should come up with training and development strategies where technical skills and competencies of existing workforce are identified and articulated, required skills are identified and strategies of addressing skills gaps are developed. Sixth, African NSOs should form and build partnerships with academic institutions and other data communities, including private sector to share technical knowledge and skills in new data production methodologies. These statistical agencies should also aim at establishing technical statistical training institutes where trainees will be offered technical training in production of official statistics.

h) Investment in modern technologies for use in production and dissemination of official statistics

Information and Communication Technology (ICT) plays a significant role in all aspects of statistical production, starting from data collection up to dissemination. The ICT landscape is dynamic and is rapidly changing and, therefore, NSOs need to keep up with these rapid changes by investing in modern technologies through acquisition of modern ICT hardware and software. Acquisition and use of modern technologies will enable NSOs to develop new products and processes, thus enabling them to overcome the challenges encountered during production and dissemination of official statistics. This will in turn reduce the cost of producing data and improve quality of statistics produced. The investment in modern technologies need to be coupled with hiring of ICT experts (data analysts, data scientists, data engineers, data miners) and young professionals to reduce shortage of employees and fill existing skills gaps, especially in modern technologies.

i) Enhancing the use of official statistics

African NSOs first need to release statistical information and statistical products in their custody for use by all users. These statistical products need to be released in user friendly formats, which are easy to use and that can be integrated with other datasets. This will enable users to access available statistics for use, which will in turn assist in identification of data gaps. This will also enhance data openness, thus improving the trust of official statistics in Africa.

Second, African NSOs need to develop an advocacy strategy for use of statistics whereby all users will be informed on the availability of the various statistical products, how they can be accessed and how they can be utilized. These offices should also provide support to data users and details on how this support can be obtained need to be clearly communicated. In addition, African NSOs should develop a dissemination strategy outlining the guidelines for disseminating and communicating official statistics and methods for dealing with errors and making revisions.

Third, African NSOs should create an engagement platform where data users, mainly policy makers, across government and lawmakers are urged to make use of available official statistics while making decisions. Engagement of data users by NSOs in Africa should be one of their core activities and this can be achieved by developing a user engagement strategy.

Fourth, African countries need to regularly train government employees, especially middle level managers, on how to analyze, interpret and communicate data for effective and efficient day to day decision-making. Fifth, official statistics should be incorporated in countries' development plans to enhance their uptake by government officials and other stakeholders. Development plans in Africa should be synchronized with production of official statistics, whereby all statistical indicators required to monitor and evaluate the development goals are clearly mapped and produced by national statistical systems.

j) Improving the trust of official statistics in Africa

There is need to enhance trust of official statistics in Africa to increase uptake of these statistics for evidence-based decision-making. First, African NSOs need to ensure adherence to the Fundamental Principles of Official Statistics in production of official statistics, which will guarantee production of quality statistical information through exercising professional independence and impartiality.

Second, African NSOs need to come up with release dates and release calendar for their regular and ad hoc statistical products. This will enable data users to know the exact date when they expect different statistical products to be released and made available for use by all users. NSOs should promptly communicate any changes made to the release schedule and reasons for the changes.

Third, dissemination of official statistics needs to be done by the Chief Executive Officers of NSOs, thus enabling these offices to exercise their independence. Fourth, there is need to build the capacity of African NSOs leadership on the best practices of producing and disseminating official statistics. This will improve the capacity of NSOs management to engage policy makers and advocate for use of official statistics in formulation and evaluation of policies. NSOs should develop strategies to promote usage of official statistics at policy level, which will in the long-run facilitate allocation of adequate resources for statistical activities.

k) Improving data governance across NSOs in Africa

The legal framework governing production of official statistics in Africa should ensure that the statistics are accurate, relevant, timely, comparable, consistent and impartial as per the Fundamental Principles of Official Statistics, and the African Charter on Statistics. African NSOs should be autonomous to enable them produce official statistics without any interference, and this will ensure that they exercise professional independence in data production, thus improving the credibility and trust of official statistics. Legislation on production of official statistics should, therefore, be anchored on the Fundamental Principles of Official Statistics and the African Charter on Statistics, which guarantees production of quality official statistics.

On succession planning, African NSOs need to develop and implement a succession strategy, which will enable transfer of managerial and technical skills from experienced staff to newly employed employees and ensure smooth running of operations even after knowledgeable staff exit the service. On corporate strategy, African NSOs should develop and implement strategic plans and national strategies for development statistics that will guide the implementation of different statistical activities and related support activities. African NSOs should develop and implement procurement plans for different statistical activities to ensure timely procurement of required materials and services. African NSOs should also strive to get adequate office space to provide favourable work environments for their workers. National statistical agencies in Africa that have not developed DQAF should develop and implement these frameworks to ensure generation of quality statistics.

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Mission

To strengthen local capacity for conducting independent, rigorous inquiry into the problems facing the management of economies in sub-Saharan Africa.

The mission rests on two basic premises: that development is more likely to occur where there is sustained sound management of the economy, and that such management is more likely to happen where there is an active, well-informed group of locally based professional economists to conduct policy-relevant research.

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