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Artificial Intelligence for Official Statistics: Opportunities, Practical Uses and, Challenges

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Abstract

In this era of digital transformation, artificial intelligence (AI) stands out as a revolutionary force across various sectors, including production of official statistics. Artificial intelligence is the ability of a digital computer or computer-controlled robot to perform tasks commonly associated with intelligent beings. AI technology harbors immense potential to revolutionize official statistics, from data collection, to data analysis, from data analysis to decision-making, from decision making to effective service delivery. AI tools are advancing and are becoming more prevalence. Integrating AI into official statistics by the national statistical organizations (NSOs) can be facilitated through guidance and frameworks that provide NSOs with practical knowledge on how to identify opportunities for integrating AI, assess and minimize risks, and develop phased implementation plans linked to clear lines of ownership that enable evaluation and iteration. NSOs may explore AI to enhance informed decision making, inform policies, and optimize operations. Furthermore, Safe and effective AI integration across national statistics offices have the potential to minimize administrative burdens, reduce cost against the use of traditional methods of data collection, improve decision-making and enhance public service delivery. Thus, this paper aims at developing strategies for and adopting AI capabilities for official statistics, provides guidance and frameworks for the adoption its adoption, highlights examples of how AI could be applied for official statistics, examines the governance required for responsible implementation of AI and, discusses various challenges NSOs may face when implementing Al for official statistics. Thus, providing insights into the use of AI and, the necessary conditions for ensuring responsible AI for Official statistics in this digital era.

1.0 Introduction

According to Wikipedia (2022) Artificial intelligence (AI) is intelligent demonstrated by machines. Unlike natural intelligence displayed by humans and animals, which involves consciousness and emotionality. Investopedia (2022) defines Artificial intelligence as the simulation of human intelligence in machines that are programmed to think like humans and mimic their actions. AI leverages computers and machines to mimic the problem-solving and decision-making capabilities of the human mind. Already, artificial intelligence is all around us, from self-driving cars and drones to virtual assistants and software that translate or invest. Impressive

progress has been made in AI in recent years, driven by exponential increases in computing power and by the availability of vast amounts of data, from software used to discover new drugs to algorithms used to predict our cultural interests. Digital fabrication technologies, meanwhile, are interacting with the biological world on a daily basis. Engineers, designers, and architects are combining computational design, additive manufacturing, materials engineering, and synthetic biology to pioneer a symbiosis between microorganisms, our bodies, the products we consume, and even the buildings we inhabit.

Although many AI applications are commercial, it can also be employed to achieve socially beneficial outcomes. Referred to as AI for Social Good, AI systems can help solve problems related to human and environmental well-being in a sustainable way, which does not harm or worsen existing inequalities. For example, (Cowls et al., 2021) used the SDGs as an assessment benchmark to evaluate AI for Social Good initiatives, finding 108 projects in total, and showed that every SDG is being addressed by at least one project involving AI. In a study by Vinuesa et al. (2020), experts were consulted about the potential of AI for the SDGs. The consensus was that 134 targets across all SDGs had the potential to be accomplished if AI was employed. At the same time, however, the experts identified 59 targets that could be inhibited by using AI. For example, the potential impact of climate change can be better understood and modelled through AI, which is necessary to achieve SDG 13 Climate Action. However, the high energy requirements of AI could jeopardize the efforts to achieve this SDG, particularly if non-carbon-neutral energy sources are deployed (Vinuesa et al., 2020). Xu et al. (2024) outlined another example of the potential benefit of AI. They showed that fertilizer management and tillage practices optimized at a local scale using machine learning and big data could reduce emissions from fertilizer by up to 38%. More specifically, examples of the benefits of AI for development include improved healthcare through accuracy and speed of diagnosis and reduced cost of treatment, climate change mitigation by increasing energy efficiency, and economic growth due to increased innovations and labour productivity, among others. As a result of these types of benefits, AI is receiving more and more attention from the official statistics communities and policy makers because it is increasingly affecting people's lives as its capabilities and use expand. Additionally, statistical institutions and policy makers need AI for more efficient, accurate and insightful results. AI can increase the relevance and quality of official statistics by providing enhanced computational capacity, increased access to data, improved data collection, automation of tasks, real-time data, enhanced data visualization, accurate insights and much more.

AI is about creating systems that can operate autonomously, make decisions and perform tasks without constant human guidance.

1.0.1 Artificial Intelligence and Official Statistics

Countries in the world have one or more government agencies (e.g national institutes) that feed decision-makers and other users with a steady flow of information. This bulk of data is referred to as official statistics. Official statistics should be objective and easily accessible and produced on a regular basis. Official statistics are generated from the collection and processing of data into statistical information by a government institution or international organization, following and in line with the principles of the United Nations fundamental principles of official statistics (UNFOPS, 2016). These bulks of data are then disseminated to help users develop their understanding about a particular topic or geographical area, make comparisons between countries or understand changes over time. Official statistics help decision makers develop informed policies that impact millions of people; It also provides a picture of a country or different phenomena through data, and images; It provides basic information for evaluations and assessments at different levels; Official statistics produce relevant, objective and accurate statistics to keep users well informed and assist good policy and decision-making. As various disciplines are beginning to took into the direction of AI for effective delivery, there is need for NSOs also begin to look into the direction of AI for official statistics purposes.

AI integration into official statistics can be facilitated through guidance and frameworks that provide national statistics organizations (NSOs) with practical knowledge on how to identify opportunities for integrating AI, assess and minimize risks, and develop phased implementation plans linked to clear lines of ownership that enable evaluation and iteration. NSOs may explore AI use to enhance informed decision making, inform policies, and optimize operations. AI may also raise concerns in official statistics circle, because, if not adopted carefully, its risks may outweigh its benefits. As a result, adoption of AI for official statistics should be receiving increasing attention from National Statistical Offices (NSOs) and the official statistics community as they are challenged to produce more, comprehensive, timely, and high-quality data for decision-making with limited resources in a rapidly changing world of data and technologies and in light of complex and converging global issues from pandemics to climate change.

There are two essential elements of the official statistics world that are paramount to AI. Data (the fundamental raw material for the work) and, Decisions (a core stated purpose of official statistics is often given as informing better decision-making by governments and others). Data and decision-making are obviously also central to many of the applications currently being developed under the banner of AI. Artificial Intelligence technology harbors immense potential to revolutionize official statistics, from data collection, to data analysis, from data analysis to decision-making, from decision making to service delivery. Moreso, AI tools are advancing and are becoming more prevalent. AI integration into official statistics can be facilitated through guidance and frameworks that provide national statistics organizations (NSOs) with practical knowledge on how to identify opportunities for integrating AI, assess and minimize risks, and develop phased implementation plans linked to clear lines of ownership that enable evaluation and iteration. NSOs may explore AI use to enhance informed decision making, inform policies, and optimize operations. Furthermore, Safe and effective AI integration across national statistics offices have the potential to minimize administrative burdens, improve decision-making and enhance public service delivery. For an effective and responsible AI there are four Elements that need to be considered which are:

1.0.2 Data

Data revolution is already here, and it will continue to grow more and more at an accelerated rate in the days and months and years to come. In this contemporary world, there is no shortage of data. Rather we have a plethora of data almost everywhere. Data is a set of values of subjects with respect to qualitative or quantitative variables. In its raw form, it is unorganized, but must be transformed, analyzed in order to be useful for policy making, monitoring and accountability and international comparison. It is an indispensable tool in official statistics. The foundation of any AI system is data. Its standardization, interoperability and quality are paramount for developing AI solutions that are both effective and reliable for official statistics. For an effective adoption of AI for official statistics the following much be ensured:

Data standardization: Ensuring that data across different systems and sources adhere to common standards is crucial for AI systems to accurately interpret and utilize the information. Standardization facilitates the seamless integration of data, enabling more comprehensive analysis and more accurate insights.

Data interoperability: This refers to the ability of different computer systems and software to exchange, understand and make use of information seamlessly. In the context of government, interoperability allows for efficient collaboration across departments and agencies, leading to cohesive and unified public services.

Data quality: High-quality data is accurate, complete and timely, making it essential for training reliable AI models. Poor data quality can lead to inaccurate predictions and biases, undermining the effectiveness of AI solutions and potentially leading to flawed decision-making.

1.0.2 Technology

The technology infrastructure within which AI operates includes not only the hardware and software but also the design principles that make AI tools accessible and effective.

Modern technology systems: Up-to-date technology infrastructures are necessary to support the complex computations and data processing requirements of AI for the production official statistics. Investing in modern systems ensures scalability, security and efficiency in AI implementations by the NSOs.

User-friendly systems: The interfaces through which users interact with AI technologies must be intuitive and accessible. This ensures that all users, regardless of their technical expertise, can benefit from AI tools and services, thereby enhancing adoption and impact of AI for official statistics

1.0.3 People

The success of AI initiatives heavily relies on the individuals who develop, manage and use them. Technical skills of the national statistics offices (NSOs) and a strategic vision are both essential in harnessing the full potential of AI for official statistics.

Technical skills & capabilities: Building a workforce with the necessary technical expertise is crucial for developing, implementing and maintaining effective AI systems for official statistics. Continuous training and development programs of NSOs staff and, ensure that staff stay abreast of AI advancements is crucial.

Strategic vision: Leadership and stakeholders must have a clear understanding of how AI can be strategically employed for official statistics purposes so as to meet organizational goals. This

vision guides the development of AI initiatives that align with the NSOs objectives and core values.

1.0.4 Process

The processes that govern the development and deployment of AI systems determine their efficiency, adaptability and ethical alignment.

Procurement: National Statistical Organizations who intends to adopt AI should employ a rigorous evaluation of AI vendors, focusing on ethical AI practices, data handling and compliance with regulations, while ensuring procurement criteria are transparent and collaborative, involving stakeholders across the NSOs departments.

Agile ways of working: Adopting agile methodologies in AI projects promotes flexibility, responsiveness and continuous improvement. This approach enables government agencies to adapt to new information, technological advancements and changing public needs efficiently.

AI governance: Establishing robust governance frameworks for AI ensures ethical considerations are integrated into AI development and usage. It encompasses aspects like transparency, accountability and fairness, ensuring AI systems align with public values and regulations.

Evaluation and quality assurance: Comprehensive risk assessments and continuous monitoring are essential to identify and mitigate AI risks, ensuring systems perform reliably, are bias-free and maintain high-quality standards throughout their lifecycle. By regularly evaluating AI applications against set benchmarks and public feedback NSOs can refine their approaches

2.0 **Possible Applications of AI in Official Statistics**

2.0.1 In Data Collection

Digital transformation in social, economy and environmental is taking place worldwide, with governments, private enterprises, and the public demanding quicker access to real-time quality data for better decision-making and social good, an output that often goes well beyond traditional statistical production capabilities. The life cycle of traditional statistical information is becoming increasingly shorter. The longer an end-user must wait for statistical information, the less valuable it becomes for decision-making. Hence, the ability to incorporate new sources of data and Big Data sources to benefit from emerging technologies such as Web Technologies, Remote Data Collection

methods, User Experience Platforms, and Trusted Smart Statistics will become increasingly important in producing and disseminating official statistics in this era.

AI can improve the productivity and efficiency of official statistics by providing enhanced computational capacity, increased access to data, improved data collection, automation of tasks, access to real-time data, enhanced data visualization and more accurate insights, among others.

For example, it can automate the data collection process, which saves time and reduces costs while gathering large amounts of data. AI can also assist statistical institutions in leveraging the potential of new data sources, such as social media, to gather additional insights and a more comprehensive understanding of an issue, which can supplement official statistics and contribute to productivity.

For example, there is an enormous growth of data that is gathered and recorded in myriad ways: from satellite and sensory data, to social network and transactional data and so on. Information and communication technology is becoming ever more advanced, processing power and data storage capacity is continuously rising, cloud solutions are emerging and applications are becoming more intelligent. These developments have been described in more depth and detail by many observers, such as Mayer-Schönberger and Cukier (2013).

Adoption of AI in data collection by NSOs is the way to go in this era. AI could to deploy in data collection in a remote and risky area where human being may not be able to reach. AI approaches can provide high accuracy official data; however, data quality can still be an issue as the algorithm will rely on training data. Additionally, there may be risks related to data privacy and security.

2.0.1 In Data Analysis

With the use of novel statistical techniques (e.g., machine learning, deep learning, natural language processing etc. Along with AI) approaches to get additional insight and understanding from data analysis of traditional data (e.g., administrative databases) and new sources of data (big data) collected from digital activity e.g web activity, social networks, online payments, transportation systems – mobile phone usage, remote sensing networks, satellite imagery, Internet of Things (machine-generated data) and to build tools to inform decision making which has become a crucial challenge (and opportunity) for national statistical offices (NSOs).

AI's analytical capabilities can profoundly impact the way national statistics organization make decisions and understand complex data. Through techniques like machine learning and predictive analytics, AI can sift through vast datasets to identify patterns, trends and insights that might elude human analysts.

Example application: social welfare programs

AI can be used to analyze socio-economic and environmental data across various demographics to identify communities in need of support, predict future demand for social welfare programs and optimize the allocation of resources. This can help in tailoring interventions more effectively and in forecasting future needs based on shifting socio-economic indicators, thus enabling more proactive and targeted support.

2.0.2 Process automation

Robotic Process Automation (RPA) and AI-driven systems can automate routine and repetitive tasks that are time-consuming for national statistics offices. This not only speeds up processes but also reduces errors, freeing up staff to focus on more complex, value-added activities.

Example application: document and application processing

National Statistics Organizations often deal with high volumes of official data processing, from many economy indications to social economy and environmental application

forms for passports and driver's licenses to tax filings. AI can automate the extraction, verification and processing of information from these data. For example, processing benefit claims can be expedited using AI to automatically verify applicants' eligibility based on the provided data, significantly reducing waiting times for citizens and operational costs for the government.

2.0.3 Content generation

AI can assist in generating and personalizing content for public sector communication, making it more relevant and accessible to different segments of the population. Natural Language Processing (NLP) and Generative AI can create informational material, respond to public inquiries and even tailor educational content to individual needs. AI approaches can assist in translating content from paper-based documents and photographic images into machine-readable format, which can help automate the extraction of relevant information from massive amounts of data and make them

available for further AI applications. This indicates that in addition to generating data, results and insights as outputs, AI approaches can also assist in producing the input data needed to put AI to work.

Example application: council meeting summaries

After a council meeting, AI tools can quickly generate summaries highlighting key decisions, upcoming projects and important discussions. These summaries can be made available on the local government website and distributed through newsletters, making it easier for residents to stay informed about local governance without having to sift through lengthy meeting records.

2.0.4 Decision Making Process

AI is about creating systems that can operate autonomously, make decisions and perform tasks without constant human guidance. AI is a machine-based system that utilizes input to deduct outputs such as, predictions, content, recommendations and decisions (OECD, 2024). Since the overall objective of official statistics to take an informed decision from the data AI is capable of doing a whole of it. AI can help improving people's well-being, contribute to economic productivity at a global level, increase innovation, and help to respond to key global challenges from health and education to climate change and hunger (OECD, 2023)

2.0.5 Capacity to Generate Better, Quality Official Statistics

AI can enhance the quality of official statistics by automating processes like data cleaning and correction. AI approaches can also assist in the analysis and comparison of data across diverse sources, helping to reduce errors and ensure accuracy. Additionally, AI can improve data quality by addressing dimensions such as timeliness (whether data are available when needed), validity (whether the data conform to defined formats), consistency (whether the data are consistent across various data sets) and uniqueness (whether the data are recorded only once in the same data set), among others (GOV.UK, 2021).

3.0 Challenges of Artificial Intelligence for Official Statistics and the Way Out

Adoption of AI for official statistics is not without challenges which require careful consideration, because like its benefits, its risks can also be quite substantial. For the adoption of AI by the NSOs for official statistics the following challenges must be overcome

3.0.1 Human Skill Development

Official statistics have sets of rules for their various operations: from data collection to data codding, from data codding to data analysis; from data analysis to information dissemination and to data communications. Creating, up skilling, developing and retaining the set of skills knowledge and talent required to extract all the potential from using AI data collection, processing, analysis, visualization and, decision making in official statistics production process are critical challenges. NSOs will have to quickly address these if they must benefit from the potential AI offers. This will have to be done both at the organizational level, identifying strengths and weaknesses, setting goals, establishing a roadmap and a strategic plan for training programs, and at the individual level, identifying gaps in core and soft skills and competencies, updating personal development plans. There is need to build the capacity of staff on the collection of big data (Statistical Engineer), big data storage (data mining), big data analysis (Statistical Analyst), data Visualization and competencies at NSOs. Appropriate knowledge of high-frequency data, spatial data, big data, micro-data are considered important for the future of data stewardship in official Statistics, which would support the value added of new data infrastructures. Developing core competencies in the new data methodologies and in the new data quality tools and frameworks are critical for the success of transformation of official statistics with the use of AI. Regarding general (soft) skills, empowering problem-solving skills, data and statistical literacy, and all indicators of ethics are considered important for the adoption of AI for official Statistics

3.0.2 Infrastructural Development

Not all countries and NSOs have the same level of access to the opportunities offered by AI. For example, most countries in Africa and others continents, AI approaches have not yet been fully deployed due to infrastructural limitations, which include issues related to access to the Internet and electricity (Centre for Intellectual Property and Information Technology Law, 2023). According to the International Telecommunication Union, in 2023, more than 2.6 billion people lacked access to the Internet (ITU, 2024). This limited access to the basic components of AI, such as electricity, connectivity and affordable devices, are contributing to widening the digital divide and inequalities (UN AI Advisory Board, 2023). For the adoption of AI for official statistics, national government, international donor agencies should support NSOs in the area of

massive infrastructural development. There should be a roadmap in stages of infrastructural development in place in term of financing the project.

3.0.3 Data Privacy and Human Rights Issue

AI have the potential to transform national statistical systems. NSOs need to revisit old and new legal and ethical dilemmas on data access and sharing (privacy and data protection), particularly outside government data. The right to access administrative data, established in principle by the law, is not adequately supported by specific obligations for the adoption of AI for official statistics. Many potential data sources for official statistics are collected by non-governmental organizations or are freely available on the web; situations that may not be covered by existing legislation, hence, for NSOs to benefit greatly in this era, the whole ethnic and legal issues need to be revisited. AI solutions should be developed and deployed ethically and responsibly to ensure that personal data are not collected without active consent and are never used in any manner that could impact individuals or communities negatively.

3.0.4 Governance Issue

Another challenge of AI is its irresponsible adoption and use of this technology due to the absence of policy frameworks governing or regulating AI at a global level. As discussed above, this could result in risks regarding data privacy and protection, as well as human rights violations more generically, all of which could jeopardize efforts to NSOs in adopting AI for the production of official statistics. Therefore, effective AI governance at a global level is necessary to address this challenge of AI. United nations and other bodies should be able to come up with policies that will govern NSOs in adopting AI for official statistics

3.0.5 Policy Formulation Issues

AI technological adoption for official statistics may imply significant public policy issues. McKinsey (2016) in its report underlines that the key for the successful adaption to the new technological conditions is the ability of NSOs to adopt the right policies. National Statistical Organizations that will not be able to follow the appropriate long-term policies will set their nations at risk, that is, when all the other NSOs will run with great speed, their inability to be adapted to the new reality will drive to the deterioration of their relevancy, the reduction of their values, and the increase in their spending with the possibility of a bankruptcy to be increased. Adoption of AI into official statistics production by NSOs should be directly related to socioeconomic growth of the nation, these policies must be in complete accordance to the Sustainable Development Goals (SGs) adopted by United Nations Member States in 2015 (Smit et. al, 2016), (Arntz et.al., 2016) But it is not only the ability of NSOs to adapt to the new conditions. There are also severe social problems that may get bigger due to this digital era, making policy intervention is crucial. Political leaders must ensure that the technological progress will work for the benefit of NSOs and not against it.

conclusion

The AI future is full of both great potential and uncertainty. Industrial revolutions have come and gone, leaving many countries on the sidelines. History is poised to repeat itself if we don't act now to build strong foundations that will enable us to be active agents rather than passive spectators in the next phase of global transformation. AI should serve as a catalyst for the production of official statistics if properly harness. AI should provide a pathway to enhanced efficiency in the production of official statistics if some of the challenges enumerated above are look into. Moreso, AI holds promise in improving data collection, data wrangling, data mining, data analysis, forecasting accuracy, decision making, leveraging on the predictive capabilities of AI in modelling social, economic, and environmental of official statistics.

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