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Big Data Analytics in Public Policymaking in Nigeria: Opportunities and Challenges

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Abstract
This research examines big data analytics in public policy in Nigeria. The 'Bounded Rationality' decision-making theory by Herbert Simon is adopted to examine the constraints that limit the full implementation of big data analytics in public policymaking in Nigeria. The study used a qualitative documentary design, with data collected from secondary sources, including the National Bureau of Statistics (NBS), the Nigeria Data Protection Act (2023), the National Information Technology Development Agency (NITDA) Act, and peer-reviewed journal articles. Analysis was conducted using thematic content analysis and triangulation. The findings showed that Nigeria had an evolving legal and institutional framework for using big data analytics in public policymaking. The study also found that big data analytics offered opportunities for evidence-based decision-making, improved public service delivery, greater transparency, economic planning, and security management. However, implementation challenges had limited its application due to poor ICT infrastructure, data privacy concerns, institutional resistance, and limited expertise. The research recommended establishing a National Big Data Centre (NBDC), strengthening the institutional framework, and encouraging inter-agency collaboration to integrate big data analytics into Nigerian public policymaking. The study concluded that good governance, public service delivery, and national development require the use of big data analytics.

Keywords: Big data analytics, evidence-based governance, digital governance, public policymaking.

1. Introduction

The use of data to inform public decision-making is not recent; however, the concepts of *big data* and *big data analytics*, together with the technologies that enable their collection, processing, and analysis, are relatively recent and continue to evolve. Public policymakers now face both new opportunities and new challenges as a result of technological breakthroughs that have increased their capacity to generate, integrate, and evaluate complex data at massive scales. In an era characterised by increasingly diverse societal needs, competing interests, and limited public resources, governments need strong analytical tools to base decisions on facts. The framework that big data analytics provides enables the extraction of relevant insights from enormous and varied datasets, in turn enabling public authorities to design policies that are more informed, timely, and effective. Thus, the incorporation of big data analytics into public policymaking is on the rise worldwide, especially in industrialised nations, where it is increasingly used to improve governance, service delivery, policy formation, and execution.

In Nigeria, as a developing country, the application of data analytics in decision-making is relatively low compared to that in technologically advanced countries. Big data analytics requires more than obtaining data. Therefore, when big data is obtained, it must be analysed professionally to derive data-driven insights. Gartner (cited in Gandomi & Haider, 2015) described data analytics as the process of scrutinising data (inspecting, cleansing, transforming, and modelling) to uncover useful information, inform conclusions, and support decision-making.

Public policymaking in Nigeria has faced recurrent challenges in addressing the complex socio-economic and developmental needs of the citizens. These challenges defied several intervening policies and approaches. Consequently, results have not matched the intended objectives due to inadequate data, weak institutional capacity, poor implementation mechanisms, and the near absence of evidence-based decision-making. The current era is highly characterised by rapid technological advancement. Therefore, big data analytics has taken a central role, offering valuable tools that provide insights to enhance the quality of public decision-making. Through enabling policymakers to collect big data and analyse structured and unstructured data, big data analytics can provide timely insights into societal needs, policy trends, and governance challenges. Against this background, this study examined the opportunities and challenges of applying big data analytics to public policymaking in Nigeria.

2. Literature Review

2.1.1 Conceptual Review

Big data refers to datasets whose size and complexity exceed the capacity of traditional data-processing tools, measured in terabytes, petabytes, and exabytes. Chen (2024) described big data as a large system composed of multiple interconnected components, making it complex and often derived from new data sources. Big data is expanding, with new sources regularly added, including business environments, schools, hospitals, entertainment centres, traffic monitoring, and both online and offline activities of individuals and groups. Similarly, the complexity of big data creates difficulties in storing and analysing large amounts of data (Mediratta, 2015). According to Gartner's conceptualisation circa 2001 (Chen, 2024), data is considered big data because it exhibits high variety, increasing volume, and high velocity. Similarly, the velocity of big data depends on the generation rate; it can be measured in time per unit. Chen (2024) noted that, in addition to Gartner's 3 Vs, big data has two more Vs (value and veracity). The value here represents purpose; in other words, the intrinsic value of big data is not realised until it is discovered. Big data 'veracity' refers to the truthfulness of data; it raises the question of whether the data can be relied upon to yield useful insights to support decision-making. Mediratta (2015) identified another V, Variability; this examines the data stream structure more closely to determine whether it is aligned, exhibits regular data features, and is dependable.

However, the development in big data has changed the structure of data, as it includes semi-structured and quasi-structured data. Data is semi-structured when it is partly structured, meaning it is not in raw form but lacks a rational model in the form of a table or an object-based chart. It is semi-structured because it allows for new attributes without requiring schema redesign. Examples include Markup languages like XML, email, and EDI. Also, semi-structured data supports nested/hierarchical data and lists, simplifying data models and relationships (Mediratta, 2015). Data analytics transforms raw data into meaningful insights. Data will be most useful and effective in offering insight only when it is high-quality and well-

processed. Therefore, data analytics is the transformation of raw data into meaningful insight to inform public policymaking.

Public policy refers to decisions about what the government decides to treat or not treat (Dye, 1972). Anderson (1975) defined it as a planned, purposive course of action undertaken by an actor or a set of actors to address a given concern. Public policy serves as a mechanism that informs governmental decisions needed to address conflicts, manage economic growth, and promote national development. The Act of analytically transforming data enables policymakers to apply different analytical approaches to public policymaking. The types of analytics range from descriptive to predictive and prescriptive. Descriptive analytics summarises historical data to provide insight into trends; diagnostics uses data to provide insights into past events; predictive uses data to forecast future trends; prescriptive uses insights from data to make recommendations. Additionally, real-time analytics enable immediate decision-making based on newly collected data.

The use of big data analytics by policymakers enables the government to fulfil its responsibilities through evidence-based decision-making. This helps maximise resource utilisation efficiency, enhance the policy's effectiveness, and ensure better societal outcomes in line with the policy's intentions. However, this process works better when supported by robust data governance and institutional capacity. Data analytics has recently continued to gain more applications, as it has emerged as an important tool that supports and boosts decision-making from businesses (private sector) and the government (public sector). The increase in data and the need to make decisions based on it have given rise to new decision-making methods, leading to predictive and prescriptive analytics. It is important to note that statistical techniques and machine learning generally play significant roles in providing decision-makers with insights from large datasets (Van Ooijen, Ubaldi, & Welby, 2019). Analysing historical data reveals future trends, which improves public decision-making. Data that will yield the required insight must be accurate. Therefore, an efficient data governance framework will promote data accessibility and security for policymaking. Both social network platforms and conventional web mining approaches have access to vast amounts of data that can be examined to provide direction for decision-making. In addition to providing vital input on policies, the methodologies can also shape the tactics and strategies that the government employs in order to make subsequent policy decisions. In a similar vein, predictive analytics can be utilised as a tool for governance. For instance, government agencies can make use of regression and classification techniques in order to forecast economic indicators and appropriately distribute resources.

According to Manyika et al. (2011), data analytics explores big data, while big data shapes public policy through real-time data collection and subsequent analysis. Emphasis is placed on advanced analytics methods, including predictive modelling. Social media network analysis has grown in recent times. It has now proven potent, as it also helps decision-makers study and understand trends in the state's political economy and address the challenges and policy needs of the people. Like Moreira et al. (2019), who emphasised data governance for accuracy, Hubbard (2010) defined effective data governance as ensuring that data obtained is secure, has integrity, and is suitable before it can meet public decision-making needs. Key governance frameworks are the CRISP-DM (Cross-Industry Standard Process for Data Mining) model, which is a structured methodology to extract insight from data and the Applied Information Economics (AIE), which utilises economic principles to evaluate the value of the obtained information in order to make guided decisions (Behringer & Belavkin, 2025).

Transitioning from a traditional, estimated approach to an evidence-based decision-making process is increasingly made possible by big data analytics (BDA). This is evident, as BDA has been proven relevant and applied across the activities of various governmental bodies and agencies, including healthcare, education, taxation, customs, and security (Hossin et al., 2023). Despite BDA's great importance to public policy outcomes, implementation challenges have continued to limit its overall impact. A common challenge is bureaucrats' reluctance to adapt to change. Similarly, public policymakers show little or no willingness to change or adopt new approaches; instead, they often resist and poorly adopt data-driven approaches in decision-making due to limited knowledge, personal interests, and institutional weakness.

Notwithstanding, BDA offers significant benefits for policymaking, as the aforementioned challenges can be minimised. According to Hassan et al. (2021), multiple approaches exist to address these challenges, including policy reform, a multi-pronged approach, capacity-building initiatives, and channelling adequate resources and investments into modern data technologies. Using the referred approach to address the challenges will bring about what Hossin et al. (2023) called 'smart governance,' the integration of BDA into governance. Put differently, it is a situation in which a data-driven insight enhances policymaking and policy implementation, thereby improving public service delivery.

2.1.2 Theoretical Framework

This research adopted Herbert Simon's 'Bounded Rationality' decision-making theory to evaluate the opportunities and challenges of big data analytics in public policymaking. The major postulation of decision-making by Herbert Simon centres on the concept of bounded rationality (Simon, 1957, cited in Cristofaro, 2017). It implies that public decisions are made based on the information available to policymakers. Herbert Simon faulted the concept of perfect rationality in economic theory and management sciences, which claims that perfect and best-choice decisions (optimal) can always be made from available information. He maintains that cognitive ability is limited. In this regard, decision-making among public policymakers will generally face three limitations. Firstly, limited information, meaning decision-makers do not have complete knowledge of all the best or possible alternatives. Instead, they make decisions based on the information available. Secondly, cognitive limitations, stating that, being human, decision-makers have limited computational abilities to process and analyse data effectively. Thirdly, time constraints, which force decisions to be made within a defined timeframe, limiting exhaustive analysis. Therefore, decision-making is constrained by time, and this prevents exhaustive analysis.

Applying bounded rationality to data-driven public policymaking revealed that large datasets alone do not guarantee the desired policy outcome. This is evident in decision-makers' struggle to utilise datasets effectively for governance and national development. In other words, despite the potential of big data analytics for public policymaking, several constraints limit its practical use. Firstly, data availability and quality constraints are present. That is the situation in which the data available to policymakers is incomplete and outdated. Consequently, the effectiveness of analysing such data becomes limited. The second constraint, is institutional and bureaucratic challenges. Policymakers in developing countries mostly rely on heuristics and socio-political interests rather than on objective data. Also, they often resist technological changes and rely on more bureaucratic cultures. Thirdly, a shortage of data scientists and/or policymakers skilled in data analytics. Fourthly, there is a push toward satisficing rather than optimising decisions because of the large amount of data available to policymakers who are not skilled (Cristofaro, 2017). Lastly, the constraints are associated with the risk of data misuse and surveillance. While

social networking sites provide vast amounts of data that could guide policy-making on common public issues, there are also ethical concerns and regulations regarding data privacy.

This study contributes to the academic literature on public policy by extending Herbert Simon's bounded rationality framework to digital-era governance in developing countries like Nigeria. From the framework, it is evident that the availability of large data does not equate to rational decision-making. Instead, utilising big data and achieving optimal results in public policymaking will yield the desired policy outcomes when there is corresponding technical expertise, institutional capacity, and strong data governance. Simon's decision-making theory (Bounded Rationality) has been criticised. Barros (2010) criticised the theory on the grounds of its low degree of specificity and its negative construction of global rationality. It is noted that while Simon's theory largely faulted mainstream economic rationality, it never provided alternative criteria for optimal decision-making. Cristofaro (2017) also criticised the theory for underestimating social and emotional factors. Notwithstanding these shortcomings, the theory offered a foundational understanding of the constraints of big data analytics in public policymaking in Nigeria.

2.2 Empirical Review

To further explore the variables in the study, this section reviewed empirical studies relevant to the study by examining the identified problems, objectives, methods, findings, and conclusions in each study. The review offered insights into the current state of knowledge, identifies areas of agreement and disagreement, and highlights existing gaps that necessitate the present study.

Hong et al. (2019) examined the role of big data in smart city development in South Korea. They investigated whether big data-based policymaking enhances public service outcomes compared to conventional decision-making. Adopted a quantitative case study design. Findings revealed that the Owl Bus routes (N-Buses) were built using big data analytics and had far higher passenger utilisation than similar conventional routes. This shows that big data can greatly enhance public service planning and policy outcomes grounded in evidence. On this note, the study concluded that public decisions can be greatly enhanced by integrating big data analytics with broader governance and societal factors.

Ongena and Davids (2023) looked at how the ability to use big data analytics affected the performance of the Dutch government. The study used a quantitative survey design and found that data-driven governance needs analytical tools, a technology infrastructure, and organisational skills. The study also found that governments should invest in big data analytics to help policymakers make decisions based on facts and improve the public sector's effectiveness.

Amisi et al. (2021) examined how relationships and cooperation between researchers and policymakers could help selected African countries employ research evidence in public governance. The study examined institutional systems that facilitate the translation of knowledge into policy. The study explored knowledge producer-policy actor interactions in South Africa, Kenya, Ghana, and ECOWAS using qualitative ethnographic case studies, interviews, document analysis, and policy case reviews. The study found that trust, sustained engagement, collaborative partnerships, and structured dialogue significantly enhanced the use of evidence in policymaking.

Zamela et al. (2022) conducted an analysis of the adoption of e-government solutions by Ghanaian government departments and agencies. The objective of the study was to determine the cultural and behavioural factors that influence public servants' willingness to utilise digital government services. A quantitative survey design was adopted, and Partial Least Squares Structural Equation Modelling was applied to analyse the data. The study indicated that employees' attitudes toward digital technology and organisational support significantly influenced e-government system adoption intentions, while perceived behavioural control did not. The study concluded that digital change in the public sector requires favourable organisational attitudes and institutional backing.

Olarewaju et al. (2021) studied the potential of digital citizen participation, social media, and information and communication technology (ICT) to increase openness and responsibility in Nigeria's budgeting process. Using an abductive qualitative case study approach, a total of 1,275 constituency projects were analysed through interviews, official documents, media reports and observations involving the BudgIT and Tracka platforms. The study found that ICT-based citizen monitoring increased transparency, reduced information asymmetry, encouraged civic participation, improved accountability and promoted the completion of public projects. On this note, the study concluded that digital technologies can strengthen evidence-based governance and improve public sector decision-making when combined with active citizen participation.

Uneke et al. (2023) also examined how Nigerian lawmakers use evidence to support their decisions, focusing on institutional structures, funding, and research collaborations. They examined five states in Nigeria and compared institutional frameworks, financing methods, policymakers' views on interactions between researchers and policymakers, and the use of research evidence in policymaking. A cross-sectional survey research design was adopted involving 209 policymakers drawn from ministries, government agencies, and the National Assembly across two geopolitical zones. Data were collected using a pre-tested, semi-structured, self-administered questionnaire based on a five-point Likert scale and analysed using IBM SPSS Version 20. The findings undoubtedly showed that evidence-based policymaking relies on researcher collaboration for insights. However, long-term research partnerships and the co-production of policymaker evidence remain limited.

Finally, Aremu et al. (2026) assessed the dominant trends of evidence utilisation among Nigerian policymakers and examined the determinants affecting evidence-informed policymaking among federal government entities. The objective was to identify the institutional and human factors related to evidence utilisation and to categorise evidence consumers**.** Using a quantitative cross-sectional survey design, the researchers collected data from 196 senior policymakers across 13 federal ministries and the National Assembly. Findings showed that policymakers could be categorised into non-users, non-systematic users and eclectic users of evidence, with policymakers possessing higher educational qualifications and longer work experience demonstrating greater utilisation of research evidence. The study concluded that strengthening analytical capacity and promoting evidence literacy among policymakers are essential for improving evidence-informed policymaking in Nigeria.

Collectively, the reviewed studies demonstrate a broad consensus that data, digital technologies, and research evidence have considerable potential to enhance public policymaking, governance, service delivery, and accountability. The studies' findings from developed to developing countries consistently demonstrate that evidence-based policymaking yields greater governmental effectiveness when supported by adequate institutional frameworks, organisational capacity, and stakeholder collaboration. Most of the studies

examined the utilisation of research, researcher-policymaker interaction, e-government adoption, and ICT-enabled citizen participation, while some studies focused particularly on big data analytics. These reflect different dimensions of evidence-informed governance. From a methodological perspective, the papers employ both quantitative and qualitative methods and offer complementary views of the phenomenon. However, these studies varied in their contexts, analytical focus, and explanatory variables, implying that institutional, technological, organisational, and human factors influence the use of evidence. Furthermore, relatively few empirical studies have comprehensively examined the opportunities and challenges of Big Data Analytics in public policymaking within the Nigerian context. This contextual and empirical gap justifies the present study.

3. Methodology

The qualitative documentary research design was adopted for the study to examine the opportunities and challenges of applying big data analytics to public policymaking in Nigeria, based on existing documentary evidence rather than primary data. The study relied exclusively on secondary sources of data. Particularly relevant sources for the data include the following statutes: Nigeria Data Protection Act (2023), Freedom of Information Act (2011), Cybercrimes (Prohibition, Prevention, etc.) Act, National Information Technology Development Agency (NITDA) Act, reports from the National Bureau of Statistics (NBS), publications from the World Bank and the United Nations, as well as peer-reviewed journal articles and other reports from various government agencies. Documents were selected for analysis based on four criteria: relevance to big data analytics and public policymaking; source credibility; publication date when contemporary developments were discussed; and direct applicability to Nigerian public policy. The extracted information was organised into thematic categories corresponding with the objectives of the study: legal and institutional frameworks, big data analytics prospects, implementation challenges, institutional capacity, data governance, and policy implications. The thematic content analysis was adopted to analyse the data. Documents were coded into themes and interpreted using thematic content analysis guided by Herbert Simon's Bounded Rationality Theory. The results were then combined to explain how institutional, technological, and governance issues affect the use of big data analytics in Nigerian public policymaking. Data triangulation was employed to compare evidence from government reports, international institutional publications, legal documents, and peer-reviewed academic literature. This procedure enhanced the validity of the interpretations and reduced the likelihood of source bias.

4. Results and Discussion of Findings

4.1.1 Opportunities of Big Data Analytics in Public Policymaking

Notable legal frameworks for data usage in Nigeria include the Nigeria Data Protection Act (NDPA) 2023. Cybercrimes (Prohibition, Prevention, etc.) Act 2015 with Amendment Act 2024, National Information Technology Development Agency (NITDA) Act (2007), Freedom of Information Act (FOIA) 2011, Central Bank of Nigeria (CBN) Regulation on Data Protection in Financial Services, Nigerian Communications Commission (NCC) Regulations on Data Privacy, National Identity Management Commission (NIMC) Act 2007. The Companies and Allied Matters Act (CAMA) 2020. The Nigeria Startup Act 2022, the National Health Act (2014), and the National Bureau of Statistics (NBS) Act. Therefore, key areas for opportunities include:

Enhanced Decision-Making

Big data analytics presents an opportunity for Nigeria to use data to drive the economy and address developmental issues through data insights. Data analytics enables governments to anticipate and handle developing concerns. Policymakers and government agencies can detect patterns and trends that may indicate potential challenges before they escalate (Magakwe, 2025). This is congruent with Chen (2024): the application of big data analytics provides the evidence-based policy design and economic planning required for national development. For instance, through the National Bureau of Statistics (NBS), the Nigerian government has utilised big data in economic planning and other large-scale data collection. Nevertheless, institutional adoption remains uneven across sectors. Comparative experiences from Estonia, China, Denmark, and South Korea illustrate that the existence of digital infrastructure alone cannot guarantee and sustain data-driven governance (Yang, 2023). Instead, how well data-driven governance works depends heavily on the following: first, communication between institutions. Second, ensuring regulations are followed; and third, continuing to invest in digital capabilities.

Economic Growth and Innovation

Big data and AI integration can be used to promote diversification of the economy, increase productivity, and attract foreign direct investment (FDI). Existing studies link AI integration to policy optimisation and productivity gains (Mediratta, 2015 and Chen, 2024). The Nigerian Startup Act (2022) further supports data-driven innovation. The Act supports digital entrepreneurs and data-driven innovation. Also, the Nigerian government has used the Bank Verification Number (BVN) system to track citizens' banking transactions, improve financial inclusion, and enable data-driven economic policy decisions.

Security and Crime Prevention

Intelligence collection, crime mapping, and predictive policing can strengthen national security. Law enforcement agencies can proactively address security challenges by analysing data trends. This aligns with Manyika et al. (2011), who argued that big data analytics is instrumental for real-time crime surveillance, detection, and policing. The Nigeria Police Force Crime and Incident Database can use effectively monitor crime patterns and boost law enforcement by tackling security challenges through analytics application.

E-Government and Transparency

Open data platforms enhance citizen trust in government. According to Moreira et al. (2019) and Hubbard (2010)**,** data-driven governance brings about transparency, trust, and accountability in government. The Freedom of Information Act 2011 allows access to public data to promote transparency and accountability in governance. The Open Treasury Portal (OTP) was established to increase fiscal transparency and accountability by providing real-time access to government expenditure data and other expenditures (Federal Republic of Nigeria, 2019). Trust outcomes remain constrained by implementation gaps. This corroborates Olarewaju et al. (2021), who noted that ICT-based citizen participation enhances transparency, accountability, and public decision-making.

4.1.2 Challenges in The Implementation of Big Data Analytics in Nigeria

Despite its potential and supporting legal frameworks, big data analytics faces major implementation challenges in Nigerian public policymaking. These limitations reflect Simon's concept of bounded rationality. The major challenges include:

Data Quality and Availability

Effective big data analytics depends on the availability, accessibility, timeliness, and quality of data. This is a persistent challenge in Nigeria and has further limited the application of big data analytics to public policymaking. The findings identified fragmented, unreliable, and outdated data as a major challenge. This finding is reinforced by Chen (2024), who suggested that data validity, also known as truthfulness, is of utmost importance for making insightful decisions. The National Data Strategy and other government frameworks have sought to increase the availability and quality of data. According to Uneke et al. (2023), they noted, although organisational data continues to be the primary source of evidence, it is plagued by institutional flaws. Additionally, Aremu et al. (2026) reinforce the finding, noting that Nigerian policymakers inconsistently used evidence across the country.

Lack of Transparency

Lack of transparency limited the application and implementation of big data analytics. This aligns with the existing literature by Moreira et al. (2019), who contend that data must be used transparently, and that robust data governance is required to yield results. For instance, hopes were high following the introduction of the Bimodal Voter Accreditation System (BVAS) and INEC Result Viewing (IReV) Portal before the 2023 general elections. It was conceived as an effort toward incorporating big data analytics tools into electoral processes to address concerns about transparency. However, the 2023 general election results were highly disputed due to widespread shortcomings (Ayeni & Aweh, 2023). The shortcomings centred on a lack of transparency, especially in the inability of the Independent National Electoral Commission (INEC) to transmit results electronically using the IReV, which was stated in INEC regulation guidelines, having been allowed in section 60(5) of the Electoral Act, 2022, to adopt any technology in the manner prescribed by the commission. It was this provision in the Electoral Act 2022 that gave the INEC the authority to publish IReV as part of the data analytics technology to be used to transmit results, which the commission failed to implement. Therefore, the failure to transmit results transparently and credibly showed an implementation gap. Addressing this for future elections requires an efficient data management approach tailored to the specific challenge, centred on data security measures and enforcement mechanisms. While the Electoral Act of 2026 replaced the 2022 Act, it also provided statutory backing for the adoption of BVAS but did not make provision for IReV. Thus, making it a discretional decision of the electoral commission. This position deviated from public expectations; therefore, it was widely criticised for weakening future electoral transparency (Premium Times, 2026; State House, Abuja, 2026; Yakwen, 2026).

Limited Technical Expertise

The shortage of proficient data scientists impedes the effective application of big data analytics in public policy formulation. Within the available legal framework for incorporating big data analytics, the majority of those responsible for public policymaking lack the knowledge to apply it effectively. The finding is supported by Ongena and Davids (2023) and Aremu et al. (2026), who found that analytical capability and organisational competence

significantly determine governmental performance, and that analytical capacity influences evidence utilisation among policymakers. The implications of this position are further emphasised by Simon's Bounded Rationality (1957, cited in Cristofaro, 2017); he noted that cognitive limitations and a lack of data knowledge deter optimal decision-making. Even among bureaucrats, governmental bodies, and agencies, there are limited technical experts to analyse and interpret data for insight. Nigeria can gain from Singapore's experience. Singapore has successfully invested heavily in data science, providing extensive workforce training to ensure government agencies have the necessary expertise in public data management and analysis (World Bank, 2020). The three-million technical talent (3MTT) DeepTech_Ready Upskilling Programme, initiated by the federal government of Nigeria in partnership with Data Science Nigeria and supported by Google.org, is an effort in the right direction. Its success will depend on effective implementation and expansion. The goal of the programme is to boost AI knowledge and train and upskill digital talent (Esene, 2025).

Institutional and Bureaucratic Barriers

Nigerian government agencies have historically functioned in isolation, exhibiting minimal inter-agency cooperation. This restricts data sharing for policy formulation. However, such cooperation is needed to gather the needed data for insight. This is consistent with Amisi et al. (2021), who found that collaboration between researchers and policymakers improves the use of data-driven evidence. Hossin et al. (2023) found results that concurred with this study's findings. Hossin et al. noted that public policymakers and bureaucrats have little or no interest in adjusting to new and better approaches, which are often technologically driven. In Nigeria, technical know-how is limited, and most public officials are unwilling to adapt to technological changes. These have consequently limited the use of big data analytics in public policymaking (Mohammed & Bello, 2024). To address this situation, Nigeria must come to terms with approaches like the 'Open Data Initiative' practised in the United Kingdom, which enhances inter-agency collaboration (Department for Business, Innovation and Skills [BIS], 2014).

Weak Data Protection and Privacy Regulations

The NDPA 2023 makes provisions for data protection and privacy. However, enforcement remains limited. Core challenges include unauthorised access to data, ethical use, and privacy breaches. This finding is lent credence by Ongena and Davids (2023), who also emphasised that organisational capability and governance structures are required for successful data utilisation. Similarly, the finding also aligned with an earlier study by Hubbard (2010), who linked the successful implementation of a big data-driven approach to ethical concerns and data privacy regulations. Nigeria can benefit from the General Data Protection Regulation (GDPR) of the European Union (EU); the approach ensures strict measures to guarantee data compliance and prioritise better data security and user privacy rights (General Data Protection Regulation [GDPR], 2016).

Infrastructure Deficiencies

The digital divide is among the factors limiting the application of big data analytics in policymaking. The limitation is most apparent in rural areas owing to the wide disparity between urban and rural areas digital facilities. This position is reinforced by Mohammed and Bello (2024), who concluded that ICT infrastructure remains a major obstacle to data-driven policymaking. The availability of trustworthy data for well-informed decision-making is affected by a lack of ICT infrastructure (World Bank Group, 2019). This finding also

corresponds with Mediratta (2015), who stressed that effective big data analytics requires advanced ICT infrastructure.

Another significant infrastructural issue is an inadequate power supply. The use of big data analytics in public governance is still hampered by unstable electricity and poor internet access, mostly in rural areas. Nigeria can gain from South Korea's Digital New Deal. The project made significant investments in cloud infrastructure and high-speed internet. The initiative improved data-driven governance (Cheong & Cho, 2024).

4.1.3 Addressing the Challenges in Big Data-Driven Public Policymaking

A three-pronged approach is presented here: policy enforcement and institutional growth; investment in capacity building (skilled technical experts); and adoption of big data analytics tools.

Policy Enforcement and Institutional Growth

For Nigeria to make good use of big data analytics, it needs strong policy enforcement and institutional ability. In two separate studies, Ongena and Davids (2023) and Hossin et al. (2023) called for more potent institutional capabilities and greater commitment to analytical capacity within public institutions. This implies that strong laws will achieve little where enforcement and institutions are weak. This aligns with Simon's (1957, cited in Cristofaro, 2017) observation that enforcement of policies is necessary to overcome obstacles in public decision-making. The framework for data control needs to be made stronger. The NDPA 2023 requires more precise regulatory provisions on its oversight function, AI governance, and data retention. Along with the NDPA, there should be a public-sector data framework that establishes rules for collecting, storing, analysing, and sharing data. Setting up a standardised National Big Data Centre (NBDC) in Nigeria is needed to support institutional reforms that enable data-driven governance. The centre would collect, analyse, and disseminate public-sector data for policymaking. Government agencies should collaborate more effectively. This will bridge bureaucratic silos and enable fair data sharing for better public service delivery. Public-Private Partnerships (PPPs) can further support government data initiatives.

Investment in Capacity Building (Skilled Technical Expertise)

A major challenge is the shortage of skilled professionals. This finding is corroborated by Ongena and Davids (2023), who, in their study, showed that organisational competencies are necessary for effective big data capability. Addressing this shortage is essential for successful big data adoption. The government should prioritise training and continuous upskilling of public officials in data science. Nigerian universities can support this training through expert-led programmes (World Bank, 2020). As a proactive approach to capacity building, science, technology, engineering, and mathematics (STEM) knowledge/education and research should be promoted. STEM knowledge must be incorporated into the school's curriculum. The Nigerian government should introduce courses like big data analytics, artificial intelligence, and predictive analytics into secondary schools and higher institutions. This will strengthen future public-sector capacity for data-driven governance.

Adoption of Big Data Analytics Tools

Big data also requires advanced analytical tools to extract the needed insights. These tools must be supported by skilled data scientists to generate reliable policy insights. Essential

tools in this regard that support large-scale data storage, real-time processing, and analytics include Apache Hadoop, Spark, Google BigQuery, AWS Redshift, and MongoDB. To attain essential insights for evidence-based policy and simulation, AI-driven predictive and prescriptive analytics, supported by tools such as Watson Analytics, Google AutoML, Azure Machine Learning, and programming environments such as Python and R, are instrumental in achieving the desired policy outcome.

Also, information obtained from social media platforms can be utilised for the purpose of formulating public policy (Akinyemi, 2024, November 4). The high level of social media usage in Nigeria can provide real-time data for policymaking purposes. In light of this, the government ought to implement instruments for real-time social media analytics. Tools such as Apache Flink, Kafka, Google Trends, Brandwatch, and AI-based mood models (NLTK, TensorFlow) can provide policymakers with real-time information to inform decision-making.

5. Conclusion and Policy Recommendations

Harnessing the opportunities of big data analytics in public policymaking will transition Nigeria from traditional, bureaucratic decision-making models to a data-driven governance paradigm. Since the Nigeria Data Protection Act, among other laws, already provides a legal framework for data use in Nigeria, success in this regard requires implementing policies, strengthening institutions, investing in trained personnel, and using advanced analytics tools. Collaboration is required among governmental institutions. Therefore, public policymakers must work closely with governmental agencies such as the NDPA, NITDA, NBS, CBN, NPC, and NCC to ensure standardised data, data privacy, and data security. The measures will enhance governance, improve public service delivery, and fast-track economic growth and development. Therefore, adopting big data analytics requires more than simply adopting technology across different sectors of the economy. Instead, it requires adequate institutional reforms, regulatory enforcement, and sustained investment in human capital for data science.

The integration will also minimise resource misallocation and direct investments to areas of need. To achieve these, this study recommends the following:

1. Strengthen data governance by establishing legal and policy frameworks that will ease data collection and management, security of data, and accuracy and integrity of the data to ensure ethical usage.
2. Skill and upskill public policymakers and bureaucrats with digital knowledge and invest in digital infrastructure to attract and retain skilled digital experts.
3. Technological firms should be partnered with, as private firms can obtain and process data for public use.
4. A data-driven culture should be promoted across ministries and all governmental bodies.
5. Nigeria needs a National Big Data Centre (NBDC) to collect, process, and analyse data to provide public policymakers with actionable insights. When these measures are implemented, Nigeria will better integrate big data analytics into public policymaking. Thus, bringing about improved governance outcomes and sustainable development.

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