Digital Platformization as a Socio-technical Reconfiguration: Insights from Nigeria's Public Sector Transformation

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Abstract

This paper explores how a platformization strategy can serve as a catalyst for public sector digital capabilities and transformation in Nigeria, using the Nigeria Digital Agriculture Strategy (NDAS) as a case study. Drawing on Socio-technical Systems (STS) Theory and the multi-level perspective (MLP), the research critically examines the interactions among institutional arrangements, governance frameworks, infrastructural readiness, and ecosystem actors that shape the operationalisation of digital public infrastructure (DPI) in the Nigerian context. Through a qualitative, single case study approach involving 11 semi-structured interviews with public officials, private service providers, and development actors, the study analyzes how digital platforms can reconfigure fragmented agricultural value chains by enabling interoperability, data sharing, and coordinated service delivery. The findings highlight that while digital platforms hold significant promise for enhancing public sector efficiency and innovation, challenges related to weak middleware infrastructure, insufficient open data systems, and unsustainable financing models limit their transformative potential. The paper contributes to the literature by offering a nuanced conceptualisation of digital platformization as a socio-technical process, thereby proposing a modular, ecosystem-driven approach to DPI implementation and recommending blended financing and adaptive governance strategies to scale platform solutions. The research has broader implications for platform-based public sector reforms in similarly constrained contexts across the Global South.

Keywords: Public Sector, Digital Capabilities, Digital Public Infrastructure, Platformization, Nigeria

Introduction

This article argues that scaling public sector digital capabilities and transformation in Nigeria will be shaped increasingly by the level of digital platforms adoption in the public sector (see Janssen and Estevez, 2013). While the transformative impact of a platformization strategy in the private sector is widely recognized (see Nicholson, Nielsen and Saebo, 2021; Nieborg, Poell and van Dijck, 2022), there is still a lack of understanding with respect to leapfrogging

public sector transformation. This gap is particularly significant in less developed economies, where the adoption and implementation of digital technology remain relatively low and constrained by greater levels of institutional voids, digital division, and socio-economic development challenges. To bridge this knowledge gap, this article seeks to answer the following research question: How can platformization facilitate the development and scaling of public sector digital capabilities in Nigeria to promote digital transformation and public service reform? In particular, the research question responds to a critical gap in understanding how digital transformation strategies can be effectively designed and implemented in developing country contexts where institutional fragmentation, limited digital infrastructure, and socioeconomic constraints persist. The question is important because it seeks to bridge the gap between policy intent (as reflected in strategies like the Nigeria Digital Agriculture Strategy—NDAS) and actual implementation outcomes. It also contributes to broader global debates on how to localize digital public infrastructure (DPI) strategies in the Global South.

The specific objectives of this study are (a) to identify the drivers and enablers of a digital platformization strategy within the public sector, (b) to develop a conceptual framework that clarifies how these forces interact and operate, and (c) to understand the implications of these enablers and drivers for scaling public sector digital capabilities and transformation in Nigeria. The essence of the research objectives are to identify the drivers and enablers of a digital platformization strategy within the public sector; develop a conceptual framework that clarifies how these forces interact; and understand the implications of these enablers and drivers for scaling public sector digital capabilities and transformation in Nigeria. These objectives are essential as they collectively aim to provide both theoretical insights and practical guidance for policymakers, technologists, and development actors working to implement digital public infrastructure (DPI) in constrained contexts. They also help unpack platformization not merely as a technical solution, but also as a socio-technical process that requires alignment across governance, infrastructure, institutional capacity, and financing mechanisms.

The core issue under investigation is the limited digital transformation within Nigeria's public sector, particularly in agriculture, despite the presence of national strategies and frameworks. This limitation stems from fragmented institutional arrangements, weak middleware infrastructure, poor interoperability, and unsustainable financing mechanisms that hinder the effective implementation of DPI. The conceptual grounding for interrogating the preceding issue within the Nigerian context is anchored on Socio-technical Systems (STS) Theory, operationalized through the multi-level perspective (MLP). This framing allows for the analysis of digital platformization as a layered socio-technical reconfiguration involving institutional, infrastructural and governance elements.

This study contributes to knowledge by advancing the discourse on digital platformization as a strategic enabler of public sector transformation in less developed contexts, with a specific case study of Nigeria's agricultural sector. Conceptually, the study leverages the STS Theory through the application of the multi-level perspective (MLP) to understand how platformization unfolds within a fragmented and institutionally constrained environment. While prior studies on platformization predominantly focus on private sector innovation or advanced economies, this paper uniquely explores how digital platform strategies intersect with weak infrastructure, fragmented governance, and socio-cultural constraints in Nigeria's public sector. It introduces a novel synthesis of digital public infrastructure (DPI) and platformization as complementary strategies for enabling government transformation, expanding the theoretical understanding of how legacy systems and emergent digital architectures interact. The study's conceptual framing offers a lens for analyzing digital transformation not as a linear technology adoption process, but as a layered socio-technical reconfiguration involving policy, governance, institutional capacity, and

ecosystem readiness. Empirically, the study provides a qualitative assessment of the Nigeria Digital Agriculture Strategy (NDAS) as a digital platformization use case. It documents how digital platforms can be operationalized as socio-technical infrastructures to enhance data sharing, interoperability, and coordination across Nigeria's fragmented agricultural value chain. The research highlights how NDAS is positioned to support smallholder farmers by integrating extension services, weather and crop data, and market access into a unified digital ecosystem. In doing so, it reveals key barriers such as underdeveloped middleware infrastructure, lack of open data systems, and limited financial sustainability that constrain public sector digital capabilities in Nigeria. Furthermore, the study highlights the potential role of institutions like the Bank of Agriculture (BoA) and mechanisms such as blended finance and innovation challenge funds in scaling DPI for agricultural transformation.

The remainder of this paper is structured as follows. The next section presents the framing of the dynamics of digital platformization in public sector transformation. This is followed by the conceptual and analytical foundations of the study ny drawing on STS Theory and the MLP. This is then followed by a detailed explanation of the research methodology, including the case study approach and data collection strategy. The ensuing section presents the empirical findings from the Nigerian context, organized around key drivers, enablers, and implementation challenges. The section thereafter discusses these findings in light of the conceptual framework, extracting key insights for policy and practice. The final section concludes the paper with a summary of contributions, recommendations, and directions for future research.

Digital Platforms and Platformization Strategy

Digital platforms are adaptable technological systems composed of a multi-layered structure, featuring a stable core and flexible complementary modules, where each component can be independently enhanced or innovated upon within an interactive hub for multi-sided value generation (Gawer and Cusumano, 2002; Senyo, Effah and Osabutey, 2021; Senshaw and Twinomurinzi, 2022). A platformization strategy is therefore one that makes digital platforms the infrastructural core of an organization (see Janssen and Estevez, 2013; Sharma et al., 2024).

Globally, digital platforms have been transformative, driving innovation, efficiency, and market competitiveness across industries, providing businesses with the flexibility to integrate various technologies, streamline operations, and deliver new value to customers (see Brenner, 2018). By connecting different stakeholders such as producers, consumers, and third-party developers, platforms enable seamless interaction and create ecosystems that foster collaboration and innovation (see Kretschmer et al., 2022). One key to the success of digital platforms is their ability to scale quickly, allowing companies to reach larger audiences and expand their market presence (see Guillén, 2021). For example, E-commerce platforms have enabled businesses of all sizes to operate globally, thereby reducing barriers to entry while enhancing customer experiences with personalized services and instant transactions.

Also, digital platforms facilitate access to data-driven insights, empowering businesses to make informed decisions, optimize supply chains, and enhance product offerings. In addition to improving operational efficiency, digital platforms have also enabled private sector companies to innovate faster. Through modular architectures and open APIs, businesses can incorporate emerging technologies such as artificial intelligence (AI), blockchain, and cloud computing into their operations without overhauling existing systems , minimizing the reliance on a rigid connection between the physical and logical layers (Tilson, Lyytinen and Sørensen, 2010; Senyo et al., 2021; Sharma et al., 2024). This flexibility allows

for continuous improvement, ensuring that companies remain agile and responsive to evolving market demands by leveraging reusability and resource sharing to generate new valuable outcomes at significantly lower costs (Fishenden and Thompson, 2013; Agarwal et al., 2015; Nambisan et al., 2017).

Public Sector Digital Platforms Adoption

Given the success of digital platforms in the private sector, organizations in the public sector are increasingly adopting platformization as a key strategy for digital transformation (Senyo et al., 2021). Estonia is often regarded as a leading example of digitization in the public sector (Śledziewska and Włoch, 2021). In 2001, the Estonian government introduced the X-Road platform that facilitates the integration of databases and information exchange among public institutions, businesses, and citizens. The platform connects over 1,300 technology systems, allowing for the provision of a diverse range of public services—E-voting, E-tax Board, E-business, E-banking, E-ticketing, and E-school— to citizens via a digital identity card. This identity is verified with a unique code, along with another code for confirming transactions such as signing contracts. The adoption of these new technologies, which promote platformization and datafication, holds significant potential for transforming the delivery of public services (Vaira, 2022).

The United Kingdom's Government-as-a-Platform (GaaP) website is another exemplification of a consistent transformation of the hierarchical structure within government and administration. The unified core infrastructure comprises shared digital systems, technologies, and processes that facilitate the development of user-friendly government services. This infrastructure consists of essential functionalities that serve as building blocks for creating new services, including identity verification (Verify), message sending (Notify), payment processing (Pay), and collaborative service design (Design system). These extensive organizational changes are shaping public administration into a digital platform ecosystem that fosters the development of new cost-effective and more valuable services for citizens. Also, the relationship between the state and its citizens is evolving towards a collaborative approach to building solutions on the basis of platformization principles such as modularization, openness, and cocreation (see Vaira, 2022).

To facilitate the scaling of public sector digital transformation, a platformization strategy connects the public platform in close relationship with already existing private platforms that have a large user base (Janssen and Estevez, 2013). Then, leveraging the private platform's data via application programmable interfaces (APIs), third parties can develop various applications and offer them to the public, enabling access to advanced features and shared digital services at scale. The operationalization of the public platform is typically via a centralized, semi-autonomous shared services center (SSC) that enables common processes and capabilities to be implemented across multiple public agencies, thereby increasing efficiency and cost savings at higher levels of digital services access (Janssen and Joha, 2006; Sharma et al., 2024).

Nevertheless, to operationalise a digital platformization strategy within the public sector, there are critical drivers and enablers (otherwise referred to as building blocks) that accelerate such a mechanism. First is the digital capability for the effective utilization and repurposing of technological components developed externally and introduced into the public organisation. A fundamental requirement for such capability is ensuring public-private access to public data, along with the ability to reuse and share it freely, commonly known as open data, to enable institutional products and services innovation (Anttiroiko, 2016). Another key digital capability is the extent to which communication and information exchange across different departments within the public sector has been automated and enhanced towards

interoperability with the requisite standards. In Estonia, key infrastructure components include the X-Road interoperability system, which facilitates secure communication and data sharing between various information systems (see Poliarus, 2022). Other complementary building blocks include digital identity, payments, and a messaging or notification system.

Imperatives for Public Sector Digital Capabilities and Transformation in Nigeria

With respect to the requisite building blocks for adopting a digital platformization strategy within the public sector, the current configuration of Nigeria's E-government Architectural Model (Figure 1) has a critical weakness: i.e. the middleware with respect to both the application and database blocks for system integration and interoperability are non-existent, even though the shared service blocks for identity, authentication and authorization have been developed and deployed to government organizations. Without this missing link to facilitate interoperability, public sector digital systems risk remaining siloed, a situation that will undermine efforts to establish a cohesive platform-based digital ecosystem. This condition limits the ability of government organizations to share data, coordinate services, and achieve the proposed economies of scale in digital service delivery. In relation to open data, the lack of system integration will hinder the government's ability to make data accessible and interoperable across digital platforms, slowing progress toward data-driven innovation, transparency, and evidence-based policymaking.

Addressing the aforementioned weakness requires targeted investment in middleware development that prioritizes system integration and interoperability. This includes fostering collaboration across government agencies and engaging private sector expertise to design and implement scalable solutions. To this end, Nigeria's National Shared Services Center (NSSC) was established in 2022 under the operational ambit of Galaxy Backbone (GBB) to enable public and private ecosystem stakeholders to gain real-time and on-demand access to platformized digital infrastructure. But, beyond the NSSC's datacenter solutions for providing hosting and colocation platform for software/applications and hardware services to Ministries, Departments and Agencies (MDAs), the current configuration of Nigeria's E-government Architectural Model does not indicate that the center has the requisite middleware to enable interoperability and system integration across different government sectors and private ecosystem players, allowing for scalable digital solutions.

To bridge the preceding critical gap with respect to the architectural model, a modular approach that is flexible, scalable and maximizes reusability of software components as digital building blocks is proposed (see Moszoro et al., 2023). This strategy enhances cost efficiency by eliminating redundant efforts and resources in the build-out of a new full stack solution, while also preventing the repeated development of these digital building blocks from the ground up Alonso et al., 2023), thereby necessitating modifications to the current technology procurement procedures by the Bureau of Public Procurement (BPP).

Study Context: The Nigeria Digital Agriculture Strategy

On the shortfall in its elusive pathway of realizing the country's Sustainable Development Goals (SDGs) targets (Nigeria ranks 146 out of 166 Countries on the United Nations (UN) World SDG Index), the Nigerian government launched the ten-year Nigeria Digital Agriculture Strategy (NDAS) to "improve the efficiency of the Nigeria agriculture sector through the use of digital technologies both in the rural and urban area" (NITDA, 2020, v). The Implementation Framework of the NDAS consists of the digital agriculture ecosystem, architecture layers and core drivers with a platformization strategy as both a core driver and a

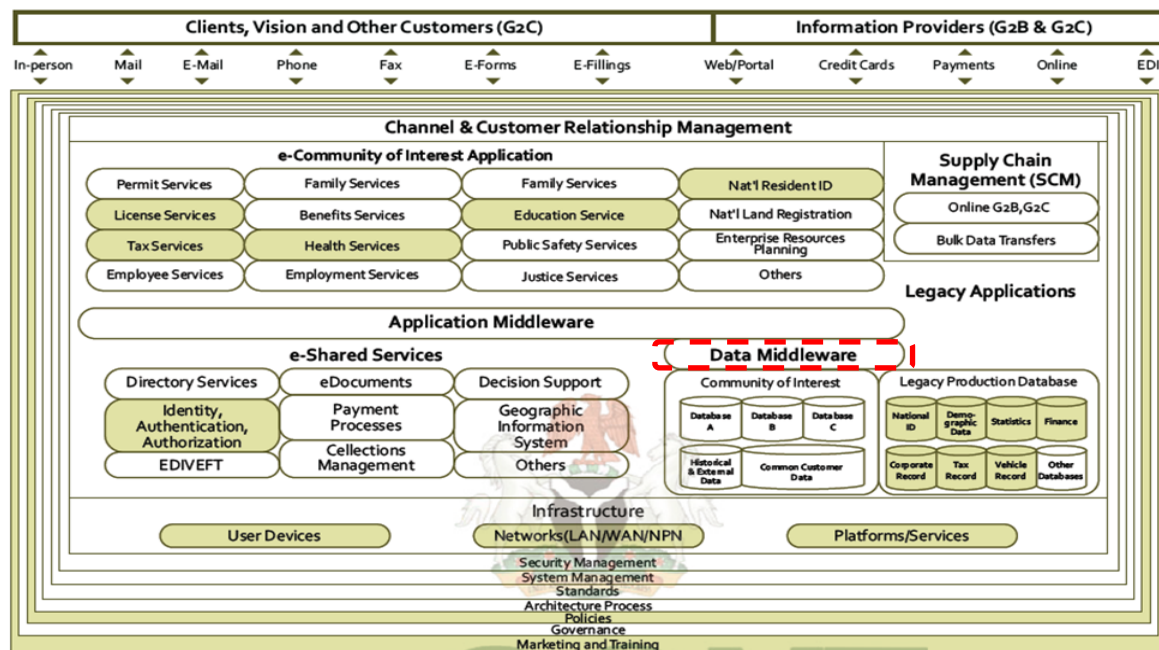key element of its implementation architecture (see Figure 2).

Figure 1: Nigeria's E-government Architectural Model
Source: NEGMP (2021)
Note: Shaded blocks indicate the components where Nigeria has achieved notable progress.

Within the preceding context, the main value proposition of the NDAS was the need for farmers and value chain players to access agricultural information and global markets at ease via an affordable digital technology driven by an ecosystem approach involving public and private sector players in the promotion of food security. A key purpose of the NDAS is to articulate policy direction and plans for the development of a digital platform for agriculture, where relevant government institutions, farmers, researchers, investors, inventors and innovators, marketers and all other stakeholders would collaborate to push their individual and collective interests. This background provides the requisite context for a use case assessment for the operationalization of the NDAS. How can these relevant stakeholders support the implementation of a digital public infrastructure (DPI) platform that integrates weather information, crop and soil advice, and access to extension services in empowering farmers to enhance their productivity by facilitating easier, cheaper and responsible data sharing between multiple data providers along the agriculture value chain? The answer to this question can be seen in the ensuing section.

Socio-technical Lens: STS and MLP as Analytical Foundations

The analytical rigor of this study is fundamentally anchored in the Socio-technical Systems (STS) Theory (see Govers and Van Amelsvoort, 2023), which posits that organizational performance and transformation are outcomes of the intricate interplay and interdependence between social and technical elements. This perspective moves beyond a purely technological determinism, recognizing that technology adoption is always embedded within a social context where human agency, organizational structures, and institutional norms critically

shape technological outcomes and vice-versa. The social components—including individuals, teams, organizational structures, and cultural norms—are inextricably linked with technical components, such as tools, processes, and infrastructure. Effective transformation, therefore, requires a holistic approach that addresses both dimensions concurrently.
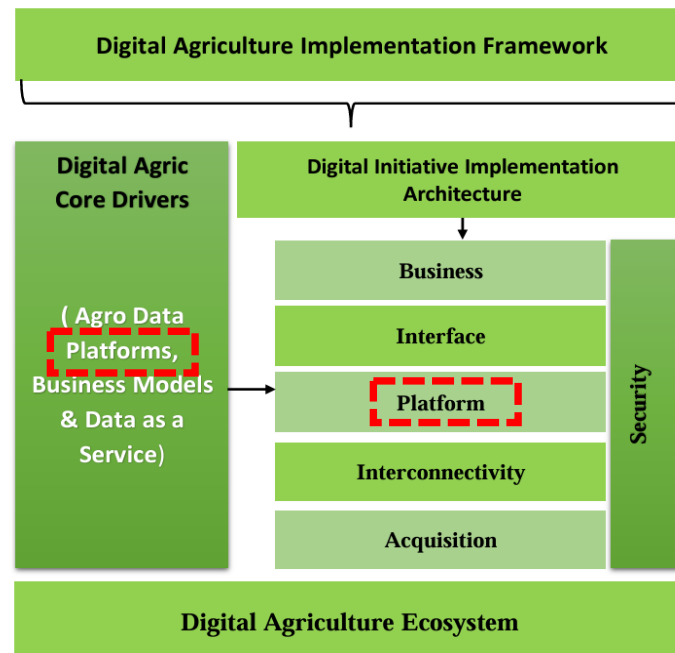

Figure 2: The NDAS Implementation Framework
Source: Self-generated by the Author

To operationalize STS and analyze transitions in complex systems, the study employs the Multi-level Perspective (MLP) (see Geels, 2010), which disaggregates socio-technical phenomena into three interconnected layers, providing a granular yet holistic view of change dynamics: (1) Niche-level (Micro)—this layer encompasses innovations, new practices, and emerging technologies, which are often fragile and require protected spaces to develop and gain traction; it focuses on specific actors, their daily practices, and nascent solutions that challenge or offer alternatives to the established order; (2) Regime-level (Meso)—this represents the dominant structures, rules, institutions, infrastructures, and established practices that characterize a particular system or sector; this level signifies the status quo, often characterized by inertia and resistance to radical change due to embedded interests and routines; and (3) Landscape-level (Macro)—this layer refers to broad, exogenous socio-economic, political, and cultural trends and pressures that exert influence on both niches and regimes but are largely beyond their direct control. These are the slow-moving, deep-seated forces that shape the broader context within which socio-technical transitions unfold.

The combined STS-MLP lens is crucial because it allows for a nuanced understanding of digital platformization not as a linear technology adoption process, but as a layered socio-technical reconfiguration involving institutional, infrastructural, and governance elements. This framing enables the critical examination of how digital platforms evolve as a strategic enabler within a complex, fragmented, and institutionally constrained environment, as exemplified by Nigeria's public sector.

Research Methodology

Building on the conceptual framing provided by the STS Theory and MLP, this study adopts a qualitative, interpretive, single-case study approach. This study leverages the theory from an MLP perspective to examine the socio-technical requirements of a platformization strategy for public sector digital capabilities and transformation in Nigeria. The theory enables a systemic analysis of how ecosystem actors—government agencies, private sector enterprises, civil society, and end-users—enact and leverage competences, institutional arrangements, and regulatory mechanisms to facilitate contextually grounded digital transformation (Raven, Schot and Berkhout, 2012). Drawing from MLP, the study evaluates how micro-level (actors and practices), meso-level (regimes and institutions), and macro-level (landscape trends) dynamics coalesce in the platformization process. This analytical lens provides a holistic view of how digital platforms evolve as a strategic enabler for cross-sectoral governance and public service delivery. In particular, the study explores how such transformations intersect with legacy system interdependencies, socio-institutional frictions, and adaptive capacity needs (Freeman and Perez, 1988). Within this theoretical framing, platformization is examined not just as a technological strategy, but also as a socio-technical reconfiguration process involving multiple actors, practices, and layers of institutional and infrastructural change.

Data Collection and Analysis

A qualitative, interpretive, single-case study approach (Yin, 2017; Zhang, 2020) was adopted to generate in-depth insights into the socio-technical dynamics of platformization within Nigeria's digital agriculture ecosystem. The rationale for a single-case design lies in its strength in capturing rich, contextualised understandings of complex phenomena involving multiple actors and technologies (Ritchie et al., 2013). Data were collected between June and November 2024 through semi-structured interviews, document reviews, and observation. A total of 11 interviews were conducted across public and private sector stakeholders involved in the design, coordination, or implementation of the NDAS: four interviews with officials from relevant government ministries and agencies (NITDA, FMARD, and NASRDA), including technical leads, policy planners, and DPI coordinators; four interviews with representatives of private-sector digital service providers, platform developers, and agri-tech firms participating in the NDAS ecosystem; and three interviews with donor or civil society actors providing advisory or support roles in the implementation of the strategy.

The semi-structured interview protocol was designed to elicit insights into institutional capacity, interoperability, coordination practices, data governance, platform development processes, and sociopolitical dynamics influencing the operationalisation of the NDAS. Interviews averaged 60–90 minutes in duration and were audio-recorded with consent. Transcripts were generated and anonymised for analysis. Other data sources such as official NDAS documents, digital platform blueprints, evaluation reports, and regulatory guidelines were also reviewed to triangulate interview findings. The data analysis followed an inductive thematic analysis process (Clarke & Braun, 2017), informed by STS–MLP Theory. Analysis continued iteratively until theoretical saturation was reached, ensuring that core patterns were sufficiently substantiated and aligned with the theoretical framing.

Thematic Analysis of the Findings

In order to ensure clarity, the analysis of the findings is segmented into the three subsections that ensue. The discussion is done thematically or synchronically for the sake of cohesion.

Fragmentation

The Nigerian agricultural landscape, particularly for smallholder farmers, is characterized by deeply fragmented value chains. These value chains consist of multiple, often disconnected actors, including farmer cooperatives, input suppliers, aggregators, processors, offtakers, and market intermediaries (AGRIFIN, 2021). This fragmentation contributes to inefficiencies in coordination, delays in service delivery, limited access to timely and relevant information, and a general lack of transparency across the system. As a result, smallholder farmers frequently face challenges in accessing quality inputs, securing fair market prices, and benefiting from economies of scale.

The NDAS envisions a transformation of this ecosystem through digital platformization. A DPI-based approach presents a compelling use case to digitally integrate the operations of various stakeholders within the agricultural value chain. By enabling seamless data sharing, standardized information flows, and interoperable services, such a platform could significantly reduce transaction costs, increase trust among actors, and improve overall productivity. In addition, platformization can serve as a unifying infrastructure to align both public and private sector interventions, thereby fostering a more coordinated and resilient agri-food system. In this context, strengthening public sector digital capabilities is essential to enable government institutions to play a central role in convening, regulating and stewarding this digital transformation.

Data Sharing and Interoperability

In advancing public sector digital capabilities within Nigeria's agricultural ecosystem, the NDAS recognizes data sharing as a foundational pillar for innovation, value creation, and evidence-based policymaking. Nonetheless, the effective operationalization of data sharing mechanisms remains constrained by fragmented data systems, limited institutional coordination, and underdeveloped data governance frameworks. To address these challenges, the NDAS underscores the need for integrated and interoperable national data systems that ensure safe, secure and ethical access to data while promoting trust among stakeholders. Central to enabling effective data sharing is the categorization of data, particularly the distinction between personal and non-personal data, which informs the design of regulatory protections and sharing protocols. Institutional mechanisms such as a transparency portal could be deployed to empower data subjects by granting them access to information about how their data are used or shared, further strengthening transparency and legitimacy in the system.

Sustainable and Coordinated Funding

A major constraint to agricultural transformation in Nigeria is the persistent lack of sustainable and coordinated funding for the public sector. Public financing for agriculture remains insufficient, with current budgetary allocations falling short of the level required to drive systemic change and technological adoption. This underinvestment hampers the government's ability to scale innovations, support digital infrastructure and catalyze inclusive growth within the agricultural ecosystem. While donor-driven programs and ad hoc public-private initiatives have contributed to short-term progress, they often lack the long-term sustainability needed for deep institutional and technological transformation. The NDAS presents an opportunity to reimagine funding models by promoting collaborative mechanisms that bring together the public sector, private investors, startups, and development partners.

A mix of funding instruments can be leveraged to support such an initiative. Specific

funds targeting technological innovations in agriculture in the country can provide financial support. The NADF which has provisions within its scope to support special interventions can be leveraged in this case to finance the implementation of the DPI use case. The BoA can also act as a co-financier, sharing risks and rewards with the private entities involved in the DPI use case implementation. Bilateral and multilateral organizations like the World Bank, Food and Agriculture Organisation (FAO), African Development Bank (AfDB), and the United Nations Development Programme (UNDP) can also be approached to provide grants or concessional loans for the development and implementation of the agricultural DPI use case. Agri-tech startups and private companies with an interest in digital agriculture can also invest in the DPI platform, with revenues generated (e.g., through subscription services on the platform) used to repay investments on a revenue-sharing models where both public and private partners share the income generated from services offered on the platform. In addition, large philanthropic organizations such as the Gates Foundation or the Rockefeller Foundation with interests in projects that aim to improve agricultural productivity and food security in Africa can also be invited to provide complementary funding. These instruments can be combined to establish a sustainable financial model that ensures the successful implementation and operation of the digital public infrastructure platform.

Digital platformization, as envisioned in the NDAS, requires not only technical capacity but also financial sustainability to ensure continuity, scalability, and impact. By developing innovative financing frameworks such as blended finance instruments, innovation challenge funds, and results-based funding, the government in partnership with institutions like the BoA can incentivize private sector participation and de-risk investment in agri-digital solutions. Also, embedding financial sustainability into the design and operationalization of DPI will be critical. This includes cost-sharing models, monetization of value-added services, and mechanisms to channel returns into reinvestment for continuous platform evolution. Strengthening the public sector's ability through institutions such as the BoA to coordinate and mobilize such funding frameworks will be pivotal to unlocking the full potential of digital innovation in reshaping Nigeria's food and agriculture systems.

Discussion

The discussion of the findings in this section is divided into the eight subsections that follow. This is done for the sake of clarity.

Reaffirming the Socio-technical Lens: STS and MLP as Analytical Foundations

A critical observation from the preceding analytical approach adopted in crystallizing the study findings is the inherent tension between aspirations for rapid leapfrogging in public sector transformation and the realities of socio-technical embeddedness. While the ambition to bypass traditional stages of development through swift technological adoption is often present in less developed economies, the study consistently demonstrates that digital transformation is not a linear process. Instead, it is a layered socio-technical reconfiguration deeply embedded within and shaped by the institutional and infrastructural realities of the context. This highlights that a purely technological leap is insufficient without corresponding socio-institutional shifts. Simplistic notions of development often driven by technological optimism therefore often clash with the complex and interdependent nature of socio-technical systems.

In addition, the MLP framework proves to be a powerful diagnostic tool for identifying points of intervention and resistance, revealing the systemic nature of challenges. By systematically categorizing challenges and opportunities at micro, meso and macro levels,

it becomes evident where interventions are most likely to succeed or encounter significant resistance. For instance, a challenge rooted in the regime-level such as institutional voids, legacy systems, or fragmented governance, demands fundamentally different strategies like policy reform or institutional capacity building than one primarily at the niche-level like a lack of specific technical skills for a new platform. The analysis, guided by MLP, reveals that Nigeria's digital transformation challenges are not isolated technical glitches but are systemic issues embedded within the meso-level regime. This implies that effective solutions must be multi-pronged and address the underlying socio-institutional structures and their interdependencies, rather than merely attempting isolated technological fixes. This diagnostic capability of MLP is critical for designing more effective and sustainable digital transformation strategies in complex environments.

Interpreting Key Findings through the STS-MLP Framework

The empirical findings of this study when interpreted through the STS-MLP framework provide a comprehensive understanding of the challenges and opportunities associated with public sector digital platformization in Nigeria. Table 1 synthesizes these key findings that illustrate their socio-technical nature and manifestation across the MLP layers.

Fragmentation: A Meso-level Regime Challenge and Socio-technical Reconfiguration

The study reveals that the Nigerian agricultural landscape, particularly for smallholder farmers, is characterized by deeply fragmented value chains. These chains consist of multiple, often disconnected actors, including farmer cooperatives, input suppliers, aggregators, processors, offtakers, and market intermediaries. This pervasive fragmentation leads to significant inefficiencies in coordination, delays in service delivery, limited access to timely and relevant information, and a general lack of transparency across the system. Consequently, smallholder farmers frequently face challenges in accessing quality inputs, securing fair market prices, and benefiting from economies of scale.

This fragmentation is a quintessential socio-technical challenge rooted primarily at the meso-level, specifically within the existing regime and its institutions. It reflects established, yet inefficient, institutional arrangements and practices that govern the agricultural sector. The disconnected actors signify a lack of cohesive social organization and trust within the existing regime, while the lack of standardized information flows points to a critical technical and infrastructural void that prevents effective coordination and data exchange. The prevailing regime characterized by these silos actively hinders the seamless flow of both social interactions and technical data, perpetuating inefficiencies.

The proposed platformization strategy, particularly through a Digital Public Infrastructure (DPI) approach, is presented as a direct socio-technical reconfiguration aimed at integrating these disparate elements. By enabling seamless data sharing, standardized information flows, and interoperable services, the platform seeks to reduce transaction costs, build trust among stakeholders, and significantly improve overall productivity. This is not merely a technical deployment; it fundamentally requires strengthening public sector digital capabilities to enable government institutions to convene, regulate, and steward this digital transformation. This represents a deliberate attempt to alter the existing meso-level regime by introducing a new, unifying technical infrastructure that necessitates and facilitates new social practices, institutional coordination, and governance frameworks

Table 1: Findings Synthesis Leveraging the STS-MLP Framework

Key Finding	Nature of Challenge/ Opportunity	Primary MLP Level	Specific Manifestation/ Impact	Proposed Socio-Technical Reconfiguration/ Solution
Fragmentation	Meso-level regime challenge	Meso	Disconnected actors, lack of standardized information flows, inefficiencies in coordination, limited access to information, lack of transparency	Platformization for integration and coordination, enabling seamless data sharing, standardized flows, interoperable services
Weak Middleware Infrastructur e & Underdevelo ped Open Data Ecosystems	Technical/Infrastruct ural constraint with social/institutional impact	Meso	Absence of middleware for interoperability, siloed systems, hindered data accessibility, slowed data-driven innovation	Targeted investment in middleware, modular approach, collaboration across agencies, NSSC development
Unsustainabl e Financing Models	Social/Institutional challenge impacting technical scalability	Meso	Insufficient public financing, reliance on ad hoc initiatives, inability to scale innovations and sustain digital infrastructure	Blended financing, adaptive governance, multi-stakeholder collaboration, cost-sharing, monetization of services

Source: Self-generated by the Author

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A deeper understanding of this fragmentation suggests that it is a symptom of institutional voids and weak governance structures, rather than solely a matter of disconnected actors. The paper therefore notes that the core issue stems from fragmented institutional arrangements. This implies that the underlying rules, norms, coordinating mechanisms, and accountability structures at the meso-level are either insufficient, absent, or poorly enforced to bind these actors into a cohesive system. The lack of standardized information flows is not just a technical oversight; it is a consequence of a lack of institutional agreement or capacity to develop and enforce such standards. Therefore, fragmentation reflects deeper, systemic weaknesses in the governance and institutional fabric of the agricultural regime. Effective platformization must address these governance deficits as much as it addresses technical integration.

Furthermore, if fragmentation defines the existing meso-level regime, then platformization as a socio-technical reconfiguration inherently aims to generate a new, more integrated regime for the agricultural sector. This new regime would be characterized by enhanced interoperability, transparent data sharing, and coordinated service delivery. Nevertheless, established regimes by their very nature possess inertia and are often resistant to fundamental change due to embedded interests, power dynamics, and socio-institutional

frictions. Actors that benefit from the existing fragmented system or those who lack the capacity, incentive, or trust to adapt to new digital ways of working might actively or passively resist this reconfiguration. This means that successful platformization will require not just technical rollout but also significant efforts in stakeholder engagement, capacity building, incentive alignment, and potentially, regulatory reforms to overcome this embedded resistance and foster the adoption of new collaborative practices within the emerging regime.

Weak Middleware Infrastructure and Underdeveloped Open Data Ecosystems: Technical Constraints with Deep Socio-institutional Roots

The study identifies a critical weakness in Nigeria's E-government Architectural Model: i.e. the non-existence of robust middleware components for both application and database blocks. These components are essential for system integration and interoperability. This missing link leads to public sector digital systems remaining siloed, which fundamentally undermines efforts to generate a cohesive platform-based digital ecosystem and severely limits the government's ability to share data and coordinate services effectively. Concurrently, the lack of system integration stemming from this middleware deficit hinders the government's ability to make data accessible and interoperable across digital platforms, thereby slowing progress toward data-driven innovation, transparency, and evidence-based policymaking.

These challenges are primarily technical and infrastructural constraints within the STS framework; yet, their impact is profoundly social and institutional. The absence of robust middleware directly impacts interoperability and data sharing, which are crucial social aspects for collaboration and innovation. At the meso-level (regime and institutions), this reflects a fundamental infrastructural void within the established E-government architecture, preventing the seamless flow of information vital for a functional digital public service. The underdeveloped open data ecosystems further highlight a lack of institutional frameworks, data governance protocols, and shared practices necessary to facilitate the social value generation from public data. These technical gaps are not isolated but are deeply intertwined with the institutional capacity and willingness to invest in and coordinate shared digital infrastructure.

Thus, the paper advocates for targeted investment in middleware development and fostering collaboration across government agencies and engaging private sector expertise as necessary socio-technical solutions. The proposed modular approach for building digital components is a technical strategy that, when combined with necessary modifications to current technology procurement procedures and inter-agency collaboration, forms a comprehensive socio-technical response to overcome these meso-level infrastructural and institutional limitations. The establishment of the NSSC represents an opportunity for such a socio-technical solution, provided it addresses the middleware gap.

A significant observation is that middleware functions as the 'nervous system' of socio-technical integration and its absence leads to a form of systemic paralysis. The paper refers to middleware as the missing link. In a complex socio-technical system, middleware is more than just a technical component; it functions as the crucial conduit that enables disparate social actors such as different government agencies, citizens, and private sector entities and technical systems like databases and applications to communicate, interact, and exchange information seamlessly. Without this foundational layer, the entire system suffers from a form of 'systemic paralysis,' whereby information cannot flow efficiently, leading to siloed operations and making coordinated action and integrated service delivery virtually impossible. This highlights that seemingly technical components like middleware are, in fact, foundational to enabling complex social interactions, fostering collaboration, and ensuring the effective functioning of institutional processes within a digital regime. Its absence is not a

minor bug but a fundamental structural flaw preventing socio-technical integration.

Furthermore, the interplay between technical infrastructure and trust is critical in fostering open data ecosystems, underscoring the challenge of data governance. The paper discusses underdeveloped open data ecosystems and the necessity for integrated and interoperable national data systems that ensure safe, secure and ethical access to data while promoting trust among stakeholders. This reveals a deeper, cyclical relationship: robust technical infrastructure like middleware is a prerequisite for enabling data sharing, but trust is equally essential for sustaining and expanding an open data ecosystem. If stakeholders do not trust the security, privacy, or ethical handling of their data within the system, they will be reluctant to share them, regardless of the technical capability. This implies that socio-technical solutions must simultaneously address technical deficiencies such as building middleware and build institutional trust through robust data governance frameworks, clear regulatory protections and transparent mechanisms like a transparency portal. The challenge of data governance thus emerges as a critical socio-institutional hurdle that must be overcome alongside technical infrastructure development.

Unsustainable Financing Models: A Social-Institutional Challenge Impacting Technical Scalability

The study identifies a persistent lack of sustainable and coordinated funding as a major constraint to agricultural transformation in Nigeria. Public financing for agriculture remains insufficient, with current budgetary allocations falling short of the level required to drive systemic change and technological adoption. This underinvestment, coupled with a reliance on short-term and ad hoc donor-driven programs, significantly hampers the government's ability to scale innovations and support digital infrastructure, thereby limiting the transformative potential of digital platforms.

This is fundamentally a social and institutional challenge at the meso-level (regime) that directly impacts the technical ability to scale and sustain digital platforms. The existing financial regime, characterized by underinvestment, fragmented resource allocation, and unsustainable funding models, acts as a critical bottleneck for digital transformation. It reflects a systemic failure in long-term planning, resource mobilization, and inter-agency coordination within the public sector's institutional framework. The inability to consistently fund and sustain digital platforms means that even technically sound solutions cannot achieve their full potential, become deeply embedded within the operational regime, or evolve over time.

Therefore, the paper proposes blended financing and adaptive governance as crucial socio-technical strategies to address this gap. The NDAS aims to "reimagine funding models by promoting collaborative mechanisms" that bring together the public sector, private investors, startups, and development partners. This includes leveraging diverse funding instruments such as specific national funds (NADF), co-financing (BoA), bilateral and multilateral support (World Bank, AfDB), private investments (agri-tech startups), and philanthropic organizations (Gates Foundation). These are not merely financial instruments; as they represent new institutional arrangements, governance practices, and collaborative models designed to generate a more resilient and sustainable financial ecosystem for DPI. Embedding financial sustainability into DPI design through mechanisms like cost-sharing models and monetization of value-added services further illustrates this integrated socio-technical approach.

A key observation is that financing serves as a critical enabler of socio-technical transitions, rather than merely an operational cost, highlighting the 'resource' dimension of the regime. In many analyses, funding is treated as a separate and purely economic or

budgetary consideration. But, within the STS-MLP framework, the study reveals that sustainable financing is a critical enabler of socio-technical transitions. Without consistent and adequate financial resources, new niches such as innovative digital platforms cannot grow, mature, and eventually challenge or transform the existing regime. The unsustainable financing models are not just budget shortfalls; they represent a systemic barrier to the evolution and diffusion of digital innovations within the socio-technical system. This emphasizes that financial models must be strategically designed with the long-term socio-technical transformation in mind, integrating incentives for adoption, scaling, and continuous sustainability, rather than merely covering initial development costs. It underscores that resource availability and allocation are fundamental components of the meso-level regime that dictate its capacity for change.

In addition, the imperative for adaptive governance to manage complex multi-stakeholder financing models and navigate power dynamics becomes apparent. The paper's proposal of blended financing and adaptive governance is particularly insightful. Blended financing involves a diverse array of actors, each with different motivations, risk appetites, and operational modalities. Managing such a complex financial ecosystem effectively requires a highly flexible, responsive and transparent governance framework. This is not just about establishing formal rules; it is about fostering the social processes of negotiation, coordination, trust-building and continuous learning among these diverse stakeholders to ensure funds are mobilized, allocated, and utilized effectively for socio-technical transformation. Moreover, the involvement of multiple funding sources can introduce new power dynamics and potential conflicts of interest. Adaptive governance becomes crucial for navigating these complexities, ensuring accountability, and aligning diverse interests toward the shared goal of sustainable digital platformization. This highlights that the social dimension of governance is paramount for the success of complex financial strategies in driving digital transformation.

Platformization as a Holistic Socio-technical Reconfiguration:
Beyond Technology Adoption

The study consistently argues that platformization, particularly in the public sector, extends far beyond mere technology adoption or deployment. It is fundamentally a complex socio-technical reconfiguration. This means that it involves a deliberate and iterative reshaping of the intricate relationships and interdependencies among technological components, human actors, organizational structures, institutional rules, and governance mechanisms. It is a process of redesigning the entire socio-technical system, not just introducing a new technical layer.

As explicitly stated in the introduction and conceptual grounding, this reconfiguration encompasses and necessitates changes across multiple dimensions: (1) Policy—the successful implementation of digital platforms requires new or adapted regulations and strategic directives to enable secure data sharing, ensure interoperability, establish legal frameworks for digital identity, and govern digital transactions; without enabling policies, technological potential remains unrealized; (2) Governance—adaptive and inclusive governance frameworks are essential to manage complex, multi-stakeholder ecosystems, ensure accountability, mitigate risks, and facilitate coordination across fragmented entities; this includes defining roles, responsibilities, and decision-making processes for platform evolution and data stewardship; (3) Institutional Capacity—building the capabilities of public sector institutions to steward, regulate, and utilize digital platforms effectively is paramount; this encompasses human capital development (skills training), process re-engineering to align with digital workflows, and organizational restructuring to foster collaboration and agility;

and (4) Ecosystem Readiness—the transformative potential of platformization hinges on the preparedness and willingness of diverse actors, including public agencies, private sector innovators, civil society organizations, and end-users, to engage with, contribute to, and derive value from the digital ecosystem; this includes addressing digital literacy, access, and trust.

Each identified challenge—fragmentation, weak middleware, and unsustainable funding—is not an isolated technical or social problem but rather a manifestation of an existing, often suboptimal, socio-technical configuration. The proposed solutions—platformization for integration, targeted middleware investment, blended financing, and adaptive governance—are all deliberate strategies for reconfiguring these interdependencies. For instance, platformization addresses fragmentation by generating a new technical layer that enables and incentivizes new social interactions and data flows, thereby re-ordering the meso-level regime. Similarly, blended financing reconfigures the social and institutional aspects of funding to enable technical scalability and sustainability, thereby transforming the resource dimension of the regime.

A crucial observation here is the iterative and emergent nature of socio-technical reconfiguration, highlighting the need for continuous adaptation. The term "reconfiguration" implies an ongoing process, not a one-time event or a static outcome. The findings, particularly in a constrained and dynamic environment like Nigeria, suggest that implementing public sector platforms is not a linear path but an iterative one. Initial technical solutions often reveal deeper social or institutional challenges, which in turn necessitate further socio-technical adjustments. This highlights that successful platformization is an emergent process, constantly adapting to feedback from the interaction between social and technical elements. It is a continuous cycle of design, implementation, learning, evaluation, and adjustment, rather than a fixed blueprint. This implies that strategies must be flexible and allow for continuous adaptation to unforeseen complexities and evolving contextual realities.

Furthermore, the potential for 'platform power' to reshape social relations and governance requires careful design and oversight. While the paper primarily focuses on the enabling and transformative aspects of platformization, a deeper understanding inherent in STS is the concept of 'platform power.' As digital platforms become the infrastructural core of public service delivery, they gain significant influence over how actors interact, what data are collected, how services are accessed and, ultimately, who benefits. This implies that the reconfiguration is not neutral; it can redistribute power, establish new dependencies, and reshape social relations within the public sector ecosystem and between a state and its citizens. The emphasis on governance becomes even more critical here, as it determines who controls the platform, whose interests are prioritized in its design and evolution, and how equitable access and participation are ensured. This raises important questions about transparency, accountability, and governance in public sector platformization, especially in contexts where institutional oversight may be weak.

Navigating Contextual Realities: Legacy Systems and Institutional Embeddedness within STS-MLP

The paper explicitly acknowledges that platformization must contend with legacy systems, cultural values, and political will, and is profoundly embedded within and shaped by the institutional and infrastructural realities of the context in which it unfolds. This directly aligns with the STS-MLP's emphasis on how existing structures, particularly at the meso-level (regimes) and influenced by the macro-level (landscape), profoundly influence the adoption, implementation, and ultimate success of new technologies. It challenges the notion that digital solutions can simply be 'parachuted' into any environment without considering the

existing fabric.

Nigeria's E-government Architectural Model's critical weakness in middleware is a prime empirical example of a legacy system constraint. Such is not merely outdated technology but a deeply entrenched technical and organizational structure that resists change due to significant sunk costs, established routines, existing interdependencies, and the sheer complexity of its replacement. Overcoming these obstacles requires more than just introducing new technology; it demands a strategic, incremental approach to integrate with or gradually replace existing components, as suggested by the modular approach.

The institutional voids and fragmented institutional arrangements mentioned in the introduction and conceptual grounding are direct manifestations of meso-level realities that hinder digital transformation. These voids, alongside socio-institutional frictions, generate inherent resistance to the adoption of new practices and technologies. The identified challenges of unsustainable funding models and underdeveloped data governance frameworks are further examples of how these deeply embedded institutional realities shape and constrain the trajectory of digital transformation in Nigeria.

The paper also highlights the crucial need for adaptive capacity in such contexts. This refers to the ability of the socio-technical system and its constituent actors to learn, adjust, and innovate in response to evolving challenges, unforeseen circumstances, and emerging opportunities. This is particularly relevant when navigating the complexities of integrating with legacy systems and addressing deeply embedded cultural and political factors. The paper's advocacy for an incremental and modular approach to building digital public platforms, one that is grounded in local realities and emphasizes reuse, standards-based interoperability, and alignment with sectoral priorities, directly reflects this need for adaptive capacity, acknowledging that transformative change is gradual, iterative, and highly context-specific.

Conclusion

The transformative potential of digital platforms in the public sector, particularly in less developed economies, hinges on a profound understanding of their intricate interplay with existing social and technical structures. This analysis, grounded in STS Theory and MLP, illuminates how digital platformization represents a complex reconfiguration, rather than a mere technological adoption, within the Nigerian public sector. By examining the NDAS as a use case, this study has critically assessed the institutional arrangements, governance frameworks, infrastructural readiness, and ecosystem dynamics that shape the operationalization of DPI in a constrained context.

The findings demonstrate that while digital platforms offer immense potential for integrating fragmented systems and unlocking new forms of value generation across the agricultural sector, the success of such initiatives depends on more than just technology deployment. Crucially, effective platformization requires coherent institutional arrangements, adaptive governance, interoperable infrastructure, and sustainable financing models. In the Nigerian context, the absence of key middleware components, underdeveloped open data ecosystems, and a lack of sustainable funding mechanisms have significantly hindered the realization of the NDAS's transformative vision.

Nonetheless, the study also reveals that opportunities exist to reconfigure the trajectory of public sector digital transformation. The establishment of the NSSC, the design of sector-specific DPI, and the potential for blended financing models offer pathways for overcoming existing constraints. Moreover, the integration of data sharing protocols, privacy-preserving technologies, and trust-building mechanisms into platform design presents a foundational step towards developing inclusive, secure and scalable digital ecosystems.

Importantly, this study underscores that platformization is not a linear or purely technical process; it is a socio-technical reconfiguration that must contend with legacy systems, cultural values, and political will. The conceptual framing developed here challenges dominant narratives of "technological leapfrogging" by showing that digital transformation is embedded within and shaped by the institutional and infrastructural realities of the context in which it unfolds.

This study makes a significant and unique contribution by explicitly applying the STS-MLP framework to a less developed context like Nigeria. While prior studies on platformization predominantly focus on private sector innovation or advanced economies, this paper uniquely explores how digital platform strategies intersect with weak infrastructure, fragmented governance, and socio-cultural constraints in Nigeria's public sector. This contextual specificity enriches the theoretical discourse by providing empirical observations from environments where institutional voids and infrastructural limitations are more pronounced.

Finally, future research could adopt comparative or longitudinal approaches to examine how platformization strategies evolve over time across different sectors or countries. In doing so, it would contribute further to the emerging body of knowledge on how digital transformation can be meaningfully enacted in low- and middle-income contexts through systemic, inclusive and sustainable design.

References

AGRIFIN Report. (2021). Ecosystem study of the digital agriculture landscape in Nigeria. https://www.mercycorpsagrifin.org/wp-content/uploads/2022/03/Ecoystem-Study-of-the-digital-agricultural-landscape-in-Nigeria.pdf

Agarwal, R., Selen, W., Roos, G. and Green, R. (2015). *The handbook of service innovation.* London, UK: Springer.

Alonso, C., Bhojwani, T., Hanedar, E., Prihardini, D., Uña, G., and Zhabska, K. (2023). *Stacking up the benefits: Lessons from India's digital journey.* Washington, DC: International Monetary Fund.

Anttiroiko, A. V. (2016). City-as-a-platform: The rise of participatory innovation platforms in Finnish cities. *Sustainability*, *8*(9), 922.

Brenner, B. (2018). Transformative sustainable business models in the light of the digital imperative—A global business economics perspective. *Sustainability*, *10*(12), 4428.

Clarke, V., and Braun, V. (2017). Thematic analysis. *The Journal of Positive Psychology*, *12*(3), 297-298.

Fishenden, J., and Thompson, M. (2013). Digital government, open architecture, and innovation: why public sector IT will never be the same again. *Journal of Public Administration Research and Theory*, *23*(4), 977-1004.

Freeman, C., and Perez, C. (1988). Structural crises of adjustment: business cycles. *Technical Change and Economic Theory.* Londres: Pinter. https://carlotaperez.org/wp-content/downloads/publications/theoretical-framework/StructuralCrisesOfAdjustment.pdf

Gawer, A. and Cusumano, A. (2002). *Platform leadership: How Intel, Microsoft, and Cisco drive Industry Innovation.* Boston, MA: Harvard Business School Press.

Geels, F. W. (2010). Ontologies, socio-technical transitions (to sustainability), and the multi-level perspective. *Research Policy*, *39*(4), 495-510.

Govers, M., & Van Amelsvoort, P. (2023). A theoretical essay on socio-technical systems design thinking in the era of digital transformation. *Gruppe. Interaktion. Organisation. Zeitschrift für Angewandte Organisationspsychologie (GIO)*, *54*(1), 27-

40.

Guillén, M. F. (2021). *The platform paradox: How digital businesses succeed in an ever-changing global marketplace*. University of Pennsylvania Press.

Janssen, M., and Estevez, E. (2013). Lean government and platform-based governance— Doing more with less. *Government Information Quarterly*, *30*, S1-S8.

Janssen, M., and Joha, A. (2006). Motives for establishing shared service centers in public administrations. *International Journal of Information Management*, *26*(2), 102-115.

Kretschmer, T., Leiponen, A., Schilling, M. and Vasudeva, G. (2022). Platform ecosystems as meta-organizations: Implications for platform strategies. *Strategic Management Journal*, *43*(3), 405-424.

Moszoro, M., Nose, M., Nunhuck, S., Pattanayak, S., del Paso, L. R., Solomon, F., ... and Uña, G. (2023). Transforming public finance through GovTech. https://www.elibrary.imf.org/downloadpdf/journals/006/2023/004/006.2023.issue-004-en.pdf

Nambisan, S., Lyytinen, K., Majchrzak, A. and Song, M. (2017). Digital innovation management. *MIS Quarterly*, *41*(1), 223-238.

Nicholson, B., Nielsen, P., and Saebo, J. (2021). Digital platforms for development. *Information Systems Journal*, *31*(6).

Nieborg, D. B., Poell, T., and van Dijck, J. (2022). Platforms and platformization. *The SAGE Handbook of the Digital Media Economy*. London, UK: Sage, 29-49.

Nigeria e-Government Master Plan (NEGMP). (2021). Federal Ministry of Communications. Abuja, Nigeria. https://fmcide.gov.ng/wp-content/uploads/2023/11/NgeGovMP.pdf

National Information Technology Development Agency (NITDA, 2020). Draft: Nigeria digital agriculture strategy (2020-2030). https://nitda.gov.ng/wp-content/uploads/2020/11/Digital-Agriculture-Strategy-NDAS-In-Review_Clean.pdf

Poliarus, V. (2022). Identification of design principles for platform engineering in the public sector. https://wwwmatthes.in.tum.de/file/dns4a156acpy/Sebis-Public-Website/-/Bachelor-s-Thesis-Vasilisa-Poliarus/TUM_Thesis_Poliarus_final.pdf

Raven, R., Schot, J. and Berkhout, F. (2012). Space and scale in socio-technical transitions. *Environmental Innovation and Societal Transitions*, *4*, 63-78.

Ritchie, J., Lewis, J., Nicholls, C. M., and Ormston, R. (2013). *Qualitative research practice: A guide for social science students and researchers*. London, UK: Sage.

Senshaw, D. and Twinomurinzi, H. (2022). Innovating with government digital platforms in low-income countries: the dynamic capabilities of Woredas in Ethiopia. *Journal of Science and Technology Policy Management*, *13*(4), 812-836.

Senyo, P. K., Effah, J., and Osabutey, E. L. (2021). Digital platformization as public sector transformation strategy: A case of Ghana's paperless port. *Technological Forecasting and Social Change*, *162*, 120387.

Sharma, D., Yadav, N., Dwivedi, Y. K. and Giannakis, M. (2024). Digital transformation of incumbent pipeline firms through platformization. *International Journal of Electronic Commerce*, *28*(2), 186-216.

Śledziewska, K. and Włoch, R. (2021). The specificity of the digital transformation of the public sector. *Ubezpieczenia Społeczne. Teoria i Praktyka*, (4), 5-29.

Tilson, D., Lyytinen, K., and Sørensen, C. (2010). Research commentary—Digital infrastructures: The missing IS research agenda. *Information Systems Research*, *21*(4), 748-759.

Vaira, V. (2022). Smart city governance and the challenge of digital platforms within the public sector. In *2022 IEEE International Smart Cities Conference (ISC2)* (pp. 1-7). IEEE. https://ieeexplore.ieee.org/iel7/9921416/9921756/09922452.pdf?casa_token=AyT4K

VL_2kYAAAAA:cQORDFdTMeejBDlAYCRi0Iuoo8y8wQ2bcNWoZMcLUMqgX1
6q6LLPkRj8UygPyia_hq8BFuv_o5h2

Yin, R. K. (2017). *Case study research and applications: Design and methods*. Thousand Oaks, CA: Sage Publications.

Zhang, J. (2020). An investigation of smart transportation system (STS) data integration within Chinese cities: A socio-technical system perspective (Doctoral dissertation, University of Sheffield). https://etheses.whiterose.ac.uk/27962/1/Jun%20Zhang%20PhD%20Thesis_final%20copy.pdf