Digital Platformisation as Public Sector Transformation Strategy: A Case of Ghana's Paperless Port

Abstract

Public sector organisations around the world are deploying digital platforms as part of their transformational strategy. However, prior research has predominantly focused on developed economies with stable institutional environments, while limited studies exist on less developed economies. Notwithstanding the digital divide, institutional voids, economic and development challenges facing less developed economies, digital platformisation as a strategy is fuelling technology leapfrogging in public sector transformation. Drawing on a case study of Ghana's paperless port digital transformation and the technology affordance theory, we address the research question: *"How can digital platformisation facilitate public sector transformation?"* Based on the findings and the technology affordance theory, this study develops a transformational affordance framework (TAF) and offers propositions on how digital platforms can enable public sector transformation.

1 Introduction

In recent years, digital platforms have become increasingly popular for transformation and disruption of business models in the private sector (Klein et al., 2020). Gawer and Cusumano (2002) define digital platform as a dynamic system of interdependent components that can each be innovated upon. Technologically, digital platforms are layered modular information and communication technology (ICT) enabled architectures with stable core components and flexible complementary modules (Tiwana et al., 2010; Yoo et al., 2010). Economically, digital platforms function as hubs for interactions and value-creation among multiple actors (Bharadwaj et al., 2013; Constantinides et al., 2018; de Reuver et al., 2017). Notable examples of digital platforms are Uber's ride hailing, Airbnb's lodging and Amazon's e-commerce platforms. Given the success of digital platforms in the private sector, public sector organisations are also leveraging platformisation as a strategy for transformation. Indeed, public sector organisations in developed economies like the UK view digital platformisation strategy as the needed "answer" to public services transformation (Brown et al., 2017). For instance, by 2015, public sector digital platform projects in the UK had attracted £1.8 billion investment, with an additional £450m exclusively for government digital service transformation (Civil Service, 2015).

While the transformational effect of digital platforms is well-established in the private sector (e.g., de Reuver et al., 2017; Klein et al., 2020), limited knowledge exists on the public sector, especially from less developed economies, where technology adoption and implementation are relatively limited (Amankwah-Amoah, 2016a; Osabutey and Jackson, 2019). For instance, research on successful digital platforms in private sector businesses such as Uber, Facebook and Airbnb is relatively abundant, whereas studies from the public sector remain limited. Given the striking differences between private and public sector operations, the need exists for research aligned with the public sector (Parker et al., 2016). Hence, deploying digital platformisation strategy in the public sector presents unique nuances for research.

So far, existing research on the strategic implementation of digital platforms in the public sector has predominately focused on developed economies (e.g., Brown et al., 2017; Ranerup et al., 2016). Moreover, significant idiosyncrasies exist between developed and less developed economies (Senyo and Osabutey, 2020). For instance, less developed economies are faced with issues of digital divide, institutional voids, economic, and development challenges (Amankwah-Amoah, 2016a). However, digital platformisation—a process of converging existing IT silos with

new technologies to generate digital platforms (Bygstad and Hanseth, 2018) as a strategy offers opportunities for technology leapfrogging in public sector transformation (Binz et al., 2012). Therefore, research is needed to provide better understanding of the effect of using new technologies (e.g., digital platforms) in the emerging world.

To address these research gaps, this study relies on a case study of Ghana's paperless port digital transformation and the technology affordance theory, which explains interactions between technologies and actors, to answer the research question: *"How can digital platformisation facilitate public sector transformation?"* In so doing, the study makes the following contributions. First, a transformational affordance framework (TAF) is developed to unpack how digital platformisation strategy can facilitate public sector transformation. By articulating this framework, we contribute to the call for research to examine the strategic role of emerging technologies in less developed economies (Amankwah-Amoah et al., 2018). Second, we provide novel explanatory propositions to make sense of transformational outcomes from digital platformisation in public sector organisations. These propositions offer new insights to reconceptualise the notion of digital platformisation, which has largely focused on the private sector environment (Parker et al., 2016). Third, the study contributes to the technology affordance theory by explicating how digital platformisation produces relational affordances for public sector transformation. Given that prior studies (e.g., Strong et al., 2014; Tim et al., 2018) have largely focused on functional affordances, this study brings new inspiration from the relational affordance perspective. Lastly, the study contributes to the public sector transformation literature by going beyond existing studies to demonstrate how digital platformisation strategy can be used as the next wave of innovation to leapfrog technological development in less developed economies (Amankwah-Amoah, 2016b).

The rest of the paper proceeds as follows. Section 2 presents the background and theoretical foundation. Section 3 discusses the research methodology and case study background, as well as data collection and analysis processes. Section 4 presents the findings. Section 5 presents discussion of the findings, the proposed transformational affordance framework, and the theoretical, practical and policy implications. Finally, Section 6 concludes the paper and presents limitations and future research directions.

2   Background and Theoretical Foundation

2.1   Digital platform and platformisation strategy

Within the information systems literature, digital platforms have been analysed from technical architecture (Tiwana et al., 2010) and socio-technical perspectives (Klein et al., 2020). In terms of architecture, a digital platform is perceived as a layered modular structure (Yoo et al., 2010) comprising a relatively stable core, evolving complementary modules, and standardised interfaces (Tiwana et al., 2010). The layered structure comprises four levels, namely device, network, service, and content (Ondrus et al., 2015; Yoo et al., 2010). The device layer deals with computer hardware and operating systems; the network layer covers communication devices and protocols; the service layer comprises application software functionalities, while the content layer consists of information resources (Yoo et al., 2010).

With their layered modular architecture, digital platforms possess capabilities for flexibility, modularity, and generativity for digital innovation (Gupta and Bose, 2019). Firstly, they enable flexibility by separating form and function (Yoo et al., 2010). Flexibility reduces the need for fixed dependency between physical and logical layers (Tilson, 2010). With flexibility, digital platforms support innovation in dynamic environments (Gupta and Bose, 2019; Nambisan et al., 2017). Modularity relates to the standardisation of interfaces between modules to enable reusability and resource sharing (Agarwal et al., 2015). With modularity, digital platforms enable organisations to decouple and reconfigure modules (Henfridsson et al., 2014) to generate new platforms and outcomes (Gupta and Bose, 2019). Finally, generativity enables the recombination and assembly of new components to extend and redistribute functionalities (Yoo et al., 2010). Generativity also enables organisations to extend and repurpose existing infrastructure to produce new digital products, services, processes, and business models (Gupta and Bose, 2019; Nambisan et al., 2017).

From the socio-technical perspective, digital platforms are considered as electronic hubs that enable interactions among actor groups (de Reuver et al., 2017; Klein et al., 2020). Enabled by digital technologies, digital platforms combine ICT artefacts including the Internet, mobile, and emerging tools to offer unique innovations. Unlike analogue technologies, which have fixed physical properties, digital technologies are editable, reprogrammable, distributed, self-referential, and data-homogeneous (Yoo et al., 2010). With such properties, digital platforms are flexible and open for innovation in response to environmental dynamics (de Reuver et al., 2017).

In recent years, digital platformisation has become a strategy for pre-digital organisations, established before the digital age. While born-digital organisations begin with digital strategies, pre-digital organisations can use digital platformisation as their transformation strategy. Usually, pre-digital organisations have silo systems for different stakeholders. However, digital platformisation can enable the design and implementation of platforms to integrate the different systems and stakeholders. Given the success of digital strategies used by born-digital organisations such as eBay, Airbnb and Amazon (Constantinides et al., 2018), some pre-digital organisations have been motivated to use platformisation as a strategy to become digital. Among the requirements for platformisation of prior silo systems are standardisation of interfaces and integration frameworks (Bygstad and Hanseth, 2018).

As a digital platform strategy, platformisation offers several benefits. For instance, it enables the automation of services previously conducted manually (de Reuver et al., 2017). Platformisation also enables knowledge sharing among internal and external actors (Bygstad and Hanseth, 2018). Nevertheless, platformisation strategies are associated with challenges such as increased complexity due to the increased number of interactions among various actors (Bygstad and Hanseth, 2018). Moreover, the evolving nature of digital technologies requires dynamic rather than static digital platforms. Another challenge is the increased complexity in governance structures, especially when third-party application developers are involved (Kazan et al., 2018). Nevertheless, digital platformisation strategy remains prominent for organisational transformation in both the private and public sectors.

2.2   Public sector transformation

In relation to information systems, public sector transformation involves ICT enabled innovations. The initial public sector transformation was the new public management (NPM) approach (Navarra et al., 2003) in the 1980s, which sought to change the public sector from traditional bureaucracy to a more efficient service sector (Rose et al., 2015). Although NPM was not fundamentally driven by ICT, it promised a radical change in culture, processes and values to promote customer-centric attitudes (Wiredu, 2012). However, NPM failed to achieve the intended goals, due largely to resistance from public servants, who opposed the attempt to introduce private sector values into the public sector (Rose et al., 2015).

Following NPM, public sector transformation moved to use ICTs such as the Internet and websites to digitalise operations (Janssen and Estevez, 2013). While the main focus was the use of ICT to improve operational activities and achieve a web presence (Janssen and Estevez, 2013), the transformation did not sufficiently extend beyond the boundaries of public sector organisations. Such a limited scope was criticised, with suggestions for more advanced transformational agenda to integrate internal and external systems (Irani et al., 2007).

Following this criticism, the next wave of public sector transformation focused on ICTs to improve internal and external processes as well as structures to promote efficiency, transparency, and accountability (Janssen and Estevez, 2013; Weerakkody et al., 2011). While such changes in public sector activities resulted in some improvements, they also led to the implementation of silo information systems. Hence, there was a need for a radical approach in transformation initiatives to quell existing limitations (Irani et al., 2007). Thus, digital platformisation, which enables interactions between multiple stakeholders (Bygstad and Hanseth, 2018; Constantinides et al., 2018) became the next wave of public sector transformation. Indeed, Janssen and Estevez (2013) identified the implementation of digital platforms as a viable strategy for public sector transformation. The authors note that, given the success of digital platforms in the private sector, the public sector could use them as a strategy to interact and serve various stakeholders.

So far, the literature on digital platformisation as a strategy in public sector transformation has concentrated on industrialised economies. For instance, Brown et al. (2017) investigated the role of platforms in the UK's public sector reform and developed a platform appraisal framework. Their study acknowledges that digital platformisation has been a significant success in the UK public sector. Similarly, Ranerup et al. (2016) asserted that public service platforms were instrumental in Sweden's successful public reforms in education, health, and pensions. In addition, their study points to how public sector platforms have inspired the emergence of new business models with value proposition, structures, networks, and financing.

In spite of the early successes of digital platformisation for public sector transformation in the industrialised world, less is known about the less developed world. Notwithstanding the digital divide, institutional voids, economic and development challenges facing less developed economies (Amankwah-Amoah, 2016a), digital platformisation strategy is fuelling technology leapfrogging in public sector transformation (Binz et al., 2012). Thus far, research on digital platformisation for public sector transformation has predominantly focused on developed economies with stable

institutional environments. However, limited studies exist on less developed economies (Amankwah-Amoah et al., 2018). As a result, it is unclear how public sector organisations in less developed economies are leveraging digital platformisation as a strategy for transformation. In response to the need for better understanding about the effect of digital platforms in the emerging world, this study investigates the transformational role of digital platforms in a public sector organisation in a less developed economy.

2.3   Technology affordance theory

Technology affordance theory (Markus and Silver, 2008) is a variant of Gibson's (1979) affordance theory, which explains relationships between technologies and actors. Technology affordance theory focuses on what actors can do with technology to achieve desired goals (Hutchby, 2001). Originally, Gibson (1979) conceptualised affordance as a complementary relationship between the environment and an animal. Applied to technology, this relationship is mirrored by actors (i.e. humans and organisations) and artefacts. In this study, such a relationship is represented by Ghana's port ecosystem (actor) and digital platform (artefact). While affordances may exist, they require the capabilities of actors and artefacts to materialise (Hutchby, 2001). Drawing from this, we define affordance as action potentials for a goal-oriented actor (Hutchby, 2001; Markus and Silver, 2008). Hence, goal-oriented actors are required to actualise affordances to achieve outcomes. Similarly, we define IT artefact as a technology object with capabilities to address a need. In the same vein, we define goal-oriented actors as individuals, groups, organisations or ecosystems that interact with artefacts to generate affordances (Markus and Silver, 2008). Following these definitions, we summarise the constructs of technology affordance theory in Table 1.

Table 1: Key constructs of technology affordance theory

Constructs	Explanation
Affordance	Action potentials of a technology for a goal-oriented actor (Hutchby, 2001; Markus and Silver, 2008)
IT artefact	Technology object with capabilities address a need (Leonardi and Barley, 2008)
Goal-oriented actors	Entities with needs which IT artefact might offer affordances to address (Markus and Silver 2008).
Functional affordances	Affordances embedded in a technology during design (Strong et al., 2014; Tim et al., 2018)
Relational affordances	Affordances that emerge from actors' interaction with technology artefact (Zheng and Yu, 2016)

Given the diversity of actors, technology affordance theory holds that people might perceive affordances differently, or not at all (Leonardi and Vaast, 2017). As a result, affordances could explain "what is offered, provided, or furnished to someone or something by an object" (Volkoff and Strong, 2013, p. 822). In similar vein, actors' needs will determine how affordances are perceived and interpreted. For instance, a social media platform can afford connectivity with friends to an individual. On the other hand, the same social media platform can afford customer engagement to an organisation. Hence, the same technology can afford multiple action possibilities to different actors. Therefore, actors need to actualise affordances to obtain outcomes. However, affordance actualisation depends on initial perception. As a result, some affordances might never be perceived or actualised (Leonardi and Vaast, 2017).

From the extant literature, technology affordance is classified into two strands, namely functional affordance and relational affordance (Tim et al., 2018). The first strand holds that technology affordances are embedded during design (Majchrzak et al., 2016). Essentially, studies (e.g., Strong et al., 2014; Tim et al., 2018) in this strand focus on articulating the functionality inscribed into technology artefacts during design as well as understanding how users interpret and actualise the embedded affordances. On the other hand, the second strand posits that technology affordances emerge from user-artefact interaction (Zheng and Yu, 2016). As a result, these two strands enable the technology affordance theory to hold a middle ground between technological determinism and social constructivism (Leonardi and Barley, 2008). Thus, from the relational perspective, technology affordance theory does not determine how technology will be used, while also acknowledging its material limitation (Thapa and Sein, 2018).

As a theory with growing interest, the technology affordance lens has been used in many contexts. However, only a handful of studies have utilised it in the less developed economy context. For instance, Dini et al. (2018) used the theory to investigate e-participation in Indonesia. Similarly, Thapa and Sein (2018) used it to investigate telemedicine in Nepal. Also, Wyche and Steinfield (2016) used the theory to investigate why Kenyan farmers do not use cell phones to access market prices. Drawing from the extant studies, it is evident that existing research within the context of less developed economies has mainly focused on how individuals can utilise the functional affordances of digital technologies. As such, there is limited understanding on the relational affordances that emerge during actor-technology interactions. More pronouncedly, prior studies tend to focus on individual or community level actualisation of technology affordances. Hence, there is limited knowledge on the application of technology affordance theory within the public sector domain in less developed economies. By focusing on digital platform affordances for public sector transformation, our study takes a different perspective and brings new inspiration to the technology affordance theory.

In this study, the focus is on understanding and theorising how digital platformisation facilitates public sector transformation. As a result, the technology affordance theory is adopted as the theoretical foundation to address the research question. We selected this theory for the following reasons. First, it offers an appropriate lens to understand affordances associated with digital transformation (Robey et al., 2013). Second, it provides a lens to theorise ICT use in a middle ground, without falling into the problem of technological or social determinism (Majchrzak et al., 2016). Third, the theory enables articulation of the capabilities of an artefact and explication of its uses, as well as implications for individual behaviour (Majchrzak et al., 2016). Lastly, this study considered technology affordance theory to be appropriate because it helps to interpret socio-technical interactions (Leonardi and Vaast, 2017).

3 Methodology

Given the paucity of empirical research on digital platformisation in public sector transformation, we adopt a qualitative case study research approach (Walsham, 2006) to obtain deeper understanding. This approach can reveal new perspectives related to under-researched, multi-faceted and complex systems or phenomena (Doz, 2011). Moreover, we set out to provide context-sensitive understanding. For these reasons, we deemed the qualitative approach

appropriate for the study. Given that digital platformisation is an emerging phenomenon in the public sector, there was a need to select a case study that provides a revelatory instantiation. For this reason, we chose Ghana's paperless port as a case study because of the digital platform transformation witnessed in this public sector environment.

3.1 Case background

Ghana is an emerging African economy (Amankwah-Amoah, 2016a; Osabutey and Jackson, 2019), with sea port activities serving as one of its major sources of government revenue. Ghana's sea ports provide services that facilitate exports and imports within the country, stretching to other neighbouring landlocked countries in the sub-region. In this study, we focus on digital transformation at the country's major sea port, Tema Port. As a large public sector environment, the port comprises several actors, namely declarants (importers and exporters), freight forwarders (clearing agents), shipping lines, the Customs division of the Ghana Revenue Authority, Ghana Ports and Harbour Authority (GPHA), scanner operators, government ministries, departments and agencies (MDA), technology solution providers, and terminal operators (Senyo et al., 2018).

Given the strategic nature of the port, successive governments have tried over the years to transform the port to achieve efficiency. Over the last three decades, there have been four major digital platform transformation reforms, geared at making the port as smart as those in Singapore and other developed countries (Senyo et al., 2019a, 2016). The use of software-based digital platforms for transformation began in 1986, when the Automated System for Customs Data (ASYCUDA) was implemented. At the time, only Customs officers used the system. Thus, there was limited data sharing. Due to some success achieved during the ASYCUD era, another digital transformation reform was implemented between 2004 and 2016. During this period, major digital platforms, namely TRADENET system, Ghana Customs Management System (GCMS), electronic ministry, department and agencies system (e-MDA), and the Ghana Integrated Cargo Clearance System (GICCS) were deployed (Senyo et al., 2019a).

In 2016, Customs took over the classification and valuation functions from the destination inspection companies, and there was need for a digital platform to perform these activities, leading to the deployment of the Pre-Arrival Assessment Reporting Systems (PAARS). On 1st September 2017, a digital transformation reform christened the "paperless port" was introduced. The main objective of this reform was to reduce face-to-face interaction between actors, reduce clearing

times, eliminate the submission of paper documents alongside electronic documents, harmonise trade processes, and enable single document submission. As such, the Joint Inspection Management Information Systems (JIMIS) was deployed to consolidate inspection processes (Senyo et al., 2019a).

3.2   Data collection

We collected data for the study from in-depth semi-structured interviews and secondary sources. Through the snowball approach, interview respondents were identified and purposively selected based on their knowledge and experience of working at the port. Our selection of participants was based on their in-depth knowledge about digital platforms and transformation within the port and how these have evolved over the years. The focus was not on how the digital platforms were designed, but how they were being used. As such, the attention was mainly on those who managed and used the digital platforms. We also collected data from secondary sources, namely websites, operating manuals and reports. By collecting data from these sources, we were able to obtain first-hand information on the digital platform transformation processes as well as performing data triangulation. For data collected from news portals, we only used direct quotes attributed to relevant actors of the port community. Hence, we did not use news commentary from the portals. In addition, we also used official documents such as Customs process manuals and reports from GPHA and Ghana Customs websites. Data collection started in September 2017 and lasted until December 2017. A total of 37 interviews were conducted involving Customs officers, freight forwarders, GPHA staff, technology solution providers, and importers. The interviews lasted on average between 60 to 80 minutes. They were tape recorded and transcribed for later analysis. Appendix A presents the data sources and details of interviewees.

3.3   Data analysis

For data analysis, we used the open, axial and selective coding technique (Corbin and Strauss, 1990). We chose this technique to achieve qualitative rigour and structure, and to overcome the challenges of analysing large unstructured data. Guided by our research question and the technology affordance theory, the analysis began by reviewing interview transcripts and identifying actions and events related to digital platform affordances that facilitated transformation in the port to develop open codes (Corbin and Strauss, 1990). Next, we analysed the open codes

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by mapping, integrating and refining excerpts and categories for conceptual similarity to derive axial codes. Lastly, we analysed the axial codes to derive selective codes by reducing the data into aggregate categories that enabled us to explain how digital platform affordances facilitated public sector transformation.

To validate our findings from the data analysis, we drew on evidence from at least two sources (i.e. interviewee data from two different respondents and secondary data sources) (see Appendix B). However, to quell the subjectivity of data from news portals, we only used direct quotations attributed to actors within the port from these sources. Based on the narration of events, activities and digital platform implementation reforms, we unearthed digital platform affordances that facilitated transformation in the port. For instance, to validate the findings on how digital platforms had reduced the number of steps needed in business processes, we used data from port process manuals, process maps on official websites, and interviews with key actors. This ensured data triangulation to verify our findings. The analysis continued through iteration between the data, findings and the theoretical foundation until we reached a saturation point. Figure 1 presents the resulting data structure on affordances and transformational outcomes that occurred as result of the port adopting digital platformisation strategy as first-order themes, second-order categories, and aggregate dimensions from the analysis.
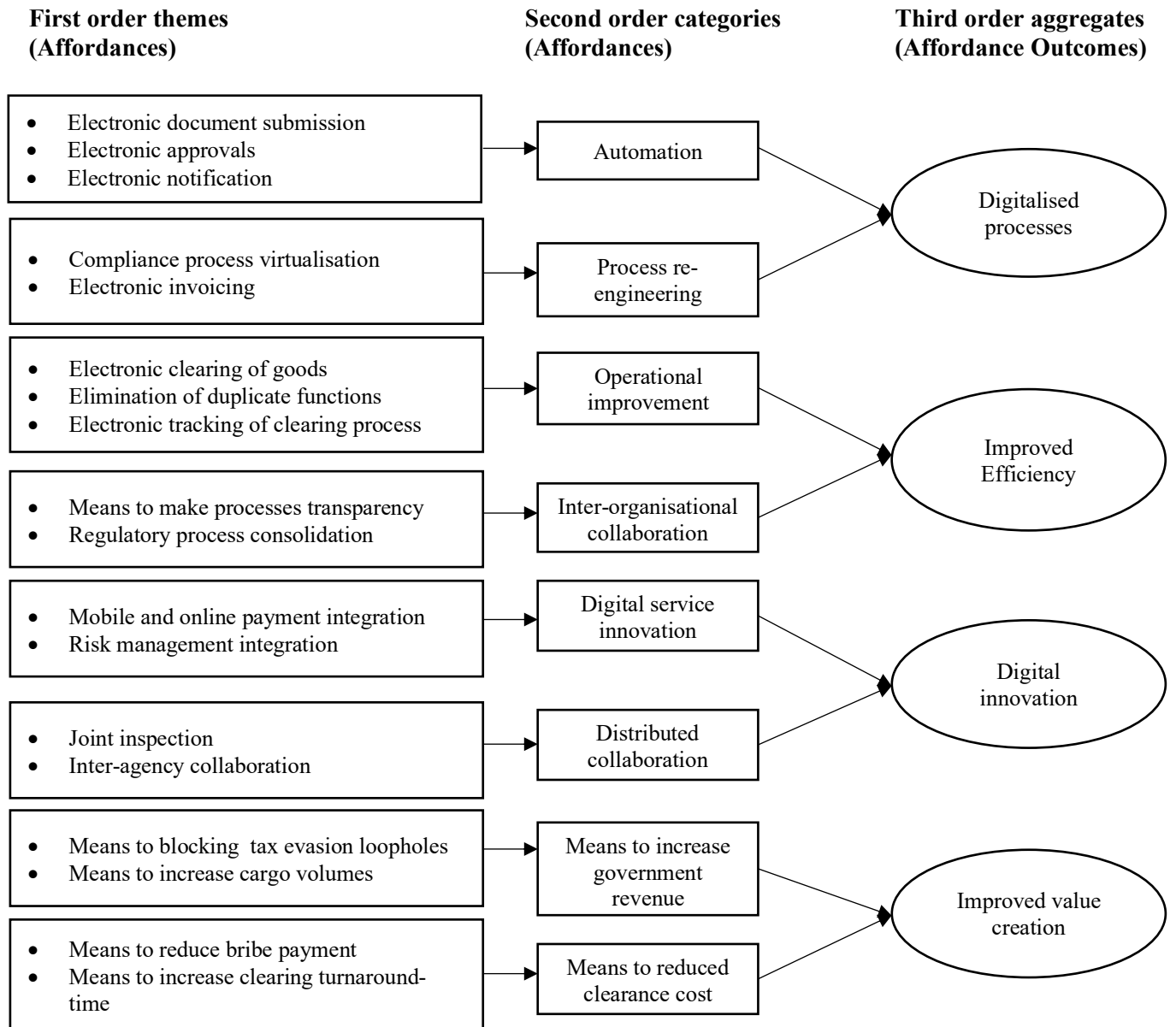
First order themes (Affordances) | **Second order categories (Affordances)** | **Third order aggregates (Affordance Outcomes)**

- Electronic document submission
- Electronic approvals
- Electronic notification

→ Automation

- Compliance process virtualisation
- Electronic invoicing

→ Process re-engineering

→ Digitalised processes

- Electronic clearing of goods
- Elimination of duplicate functions
- Electronic tracking of clearing process

→ Operational improvement

- Means to make processes transparency
- Regulatory process consolidation

→ Inter-organisational collaboration

→ Improved Efficiency

- Mobile and online payment integration
- Risk management integration

→ Digital service innovation

- Joint inspection
- Inter-agency collaboration

→ Distributed collaboration

→ Digital innovation

- Means to blocking tax evasion loopholes
- Means to increase cargo volumes

→ Means to increase government revenue

- Means to reduce bribe payment
- Means to increase clearing turnaround-time

→ Means to reduced clearance cost

→ Improved value creation

Figure 1. Data Structure

4   Findings

In this section, we present findings on how digital platformisation spearheaded the transformation of Ghana's port into a 'paperless' environment. First, we present findings from the pre and post-digital platformisation eras. Next we present findings on transformational outcomes that emerged from the digital platformisation.

4.1 Pre-digital platformisation era

The pre-digital platformisation era was largely manual and involved physical interactions between actors. As a result, the port was inundated with many inefficiencies such as long delays in clearing goods, laborious paperwork, duplicate functions, higher levels of bureaucracy and corruption, and loss of government revenue. For instance, during this era, declarants had to go through about 23 steps and submit on average 25 duplicates of each document when clearing goods, as each government agency required separate copies (De Wulf, 2005). Moreover, declarants had to move from office to office to process their documents, since there was limited collaboration between government agencies (Senyo et al., 2019a, 2016). A freight forwarder recounted:

> *"...those days [before paperless], you had to go to the Ministry of Trade and Industry to buy import declaration forms; move from one office to the other, holding multiple copies of documents for endorsement."*

As the port administration activities were largely manual, some regulatory agencies did not work efficiently, leading to slow processes and delays. Indeed, some importers complained about their containers being regularly delayed at terminals due to inefficient processes. A freight forwarder summarised the complaints as follows:

> *"... if you go to some offices, don't expect to leave early as some of the workers will be chatting while your document lies there while some will tell you I'm on break so go and come [...] and you know our work is time sensitive ...."*

A veteran freight forwarder described how they worked around the laborious processes at the port during the pre-digital platformisation era as follows:

> *"... previously, I had to send about three boys (junior freight forwarders), one to the bank, one to GPHA, and another to the examination yard so that as soon as one process is complete, the person will inform the colleague to quickly start the other process because the offices are far away from each other and time is very important in the port."*

Given that the port processes were largely manual and required constant face-to-face interactions, there were high levels of corruption, ranging from collusion, under-declaration, misclassification, tax evasion, and forgery. A freight forwarder described how corruption used to occur during the pre-digital platformisation era as follows:

"... corruption was very high because you had to go to their offices [regulatory agencies] to process your document and when you are there, you had to drop something [bribe] or else your paperwork is delayed."

Another freight forwarder reiterated:

"... the officers will deliberately delay you if you don't pay and they know that the more they delay you; your demurrage will increase [...] you also don't want to pay demurrage, so you have to give then what they want."

In other instances, some declarants connived with Customs officers to evade taxes through document tampering, falsification, under-declaration and collusion. For example, some used the same documents to clear multiple containers, leading to loss of government revenue. Although Customs had a post-clearance auditing process as a way of checking fraud, the volume of paperwork involved made it prohibitive. Hence, it was easy for corrupt declarants to manipulate the process and evade taxes. A senior Customs officer admitted:

" Those days, it was difficult to check the authenticity of documents, so far as it is stamped and signed, you have to accept it, so some unscrupulous declarants were forging documents and were able to get through [...] even some of our people [Customs officers] were conniving with declarant to rip off the state large sums of revenue."

4.2   Post-digital platformisation era

To address the challenges that plagued the initial phase, the port leveraged a digital platformisation strategy for transformation, dubbed as the paperless regime. As presented in Figure 1, we unravelled a number of affordances (presented as first order themes) that digital platforms provided in transforming the port. With the deployment of digital platforms such as ASYCUDA, GCMS, GICCS, e-MDA, PAARS, and JIMIS the port was able to leverage digital platform affordances of *electronic document submission*, *process virtualisation, electronic approval and invoicing* to automate and re-engineer its processes. As the sector commandant of Customs recounted:

"ASYCUDA marked the beginning of technology (digital platform) use by Ghana Customs at the port as all processes were previously undertaken manually."

Previously, paper documentation was submitted in duplicates of about 25 copies, but this has significantly reduced and is now submitted just once electronically. In highlighting the transformation affordance of digital platforms in the paperless era, a freight forwarder explained:

"... before paperless, some parts of the port used computers [digitalised] and some were manual so you had to process the documents on the computer and still print the hard copies [...] now with paperless, the amount of paperwork has reduced drastically."

Another freight forwarder added in agreement:

"Paperwork has drastically reduced; now you do more of the processing on the computer by submitting electronic document."

In addition, digital platform affordances also enabled process re-engineering during the post-digital platformisation era by ensuring that key processes and actors were all captured in the digital transformation. For instance, before the paperless era, freight forwarders were visiting the "long room"—an office at the port where Custom compliance officers manually verified documents one after the other. However, with process virtualisation affordances, the long room activities have been disbanded. Therefore, officers no longer have to physically meet with declarants to verify their documents. A Customs compliance officer explained:

"Previously, we were querying on paper but now [paperless era], we do this in the GCMS [digital platform], there is no physical interactions with the declarant."

During the pre-digital platformisation, we found that there was limited collaboration between government agencies, leading to process duplication and ultimately operational inefficiencies. However, through digital platform deployment, which subsequently enabled affordances such as the *elimination of duplicate functions, faster clearance processes, process transparency, and consolidation of regulatory processes,* the port was able to streamline operations and achieve increased inter-organisational collaboration between government agencies. A freight forwarder explained:

"... those days [before paperless], there were so many processes and the offices are far from each other so it was really difficult [...] you could process only a few containers in a day but now with the paperless, you don't need to move a lot and the processes have reduced so that's very good."

Also, in the post-digital platformisation era, processes have become faster and more efficient, as attested to by importers and freight forwarders. For instance, it now takes 1–3 days on average to clear goods which previously took 1–2 weeks to process. As such, clearance times have reduced and there is more efficiency at the port. This turnaround can be attributed in part to digital platform affordances that enable clearer visibility of processes to pinpoint organisations that are delaying clearance processes. Because of this visibility mechanism, no organisation wants to be identified as the one responsible for delays, which has resulted in faster processing times. A GPHA officer explained:

> *"… now with the paperless, whoever is delaying will be known so things are moving faster than before."*

Lastly, we also found that digital platformisation has contributed to reduced corruption and blockage of some tax evasion loopholes. With affordances such as digital trail generation, it has become easier for Customs to effectively conduct post-clearance audits. Thus, freight forwarders and Customs officers are mindful of corrupt deals being conducted, as there is the possibility to easily drill down on each clearance to verify corrupt activities. This has deterred corrupt actors from evading taxes or not paying appropriate duty, resulting in increased government revenue. Similarly, we found that the virtualisation of some processes through digital platform affordances has led to reduced clearance costs. Facilitation payments (bribes) that were previously paid to officers for faster clearance processes have reduced hugely, given fewer face-to-face interaction between actors. Hence, there is a limited avenue for bribe payments, leading to reduced clearance costs. In highlighting the gains made through digital platformisation with regards to government revenue, the Customs sector commandant of the Tema Port highlighted that:

> *"… there is increased revenue for government as most tax evasion loopholes are sealed and there is reduced corruption due to elimination of some physical processes…"*

Given that the port processes used to be purely manual, but eventually transformed into a paperless environment, we view digital platforms as having transformational affordances.

4.3 Transformational outcomes

Examining the pre and post-digital platformisation eras in Ghana's port, we uncovered four key transformational outcomes. As presented in Figure 1, we found that digital platformisation

produced digitalised processes, improved efficiency, digital innovation, and improved value creation as transformational outcomes. We now present each of these outcomes in detail.

Digitalised processes

With the deployment of digital platforms, the port was transformed into a digital ecosystem comprising interdependencies between actors, technologies and processes. This transformation occurred through automation and process re-engineering. As such, processes such as electronic document submission, compliance, approval and invoicing have all been digitalised. For instance, through digital platforms, processes such as compliance, that used to be predominantly physical, has been successfully digitalised. Similarly, process digitalisation at the port ended the practice of declarants submitting multiple copies of physical clearance documents separately to each regulatory agency. Now declarants only need to submit one copy of the electronic trade documents and all regulatory agencies can have access, quelling the practice of providing duplicate copies and moving from office to office. Moreover, the digitalised processes have also enabled electronic approval, notification and querying of declarations. In highlighting the effect of digitalised processes at the port, a freight forwarder explained:

> *"... now with these systems in the port, we do not need to do a lot of manual work, moving from one area of the port to the other and trying to beat time [...] I just sit in my office and complete most of the processes."*

Despite process digitalisation, some functions in the port, such as examination and preventive checks are still physical. While there have been calls for some of these functions to be merged, political interference remains a hindrance. Thus, in spite of digital platform affordances, political will remains critical in achieving holistic digitalisation. Nonetheless, the digitalised processes at the port have brought numerous benefits.

Improved efficiency

We also find the transformational outcome of improved efficiency as a result of digital platformisation. As the port processes used to be completely manual, there were lots of redundant functions, bureaucracy and duplication of work. However, with the deployment of digital platforms, the port achieved improved efficiency as a result of the electronic clearing of goods, elimination of duplicate functions, regulatory process consolidation, and increased process

transparency. As a result of operational improvements, there has also been a reduction in corruption, as there is limited physical interaction between actors. For instance, in the current paperless port, there is no longer need for physical endorsement of many documents. Hence, it is more difficult for certain actors to demand bribes. Previously, corruption was so endemic and normalised that freight forwarders collected "bribe money" as "miscellaneous payment" from importers to facilitate speedy clearance. However, with digital platformisation, there is no need for freight forwarders to pay these corrupt "facilitation fees". A GPHA officer highlighted:

> *"Now with the paperless, importers are calling for the cancelling of miscellaneous payment [bribes to make people process documents faster, e.g. stamping of documents or printing of invoices] to further reduce their cost of clearance."*

Although corruption has not been totally eliminated from the port, it has certainly reduced. The main constraint for corruption persistence includes strong bonds between actors, lenient punishment for culprits, and political interference in some port activities. Overall, operations have been streamlined and there is increased inter-organisational collaboration, resulting in the transformational outcome of improved efficiency at the port compared with the previous pre-platformisation era.

Digital innovation

We also found evidence of digital innovation through platformisation strategies implemented at the port. Following the initial digital platform deployment, the port has witnessed incremental innovation leading to the development of new services. For instance, because of digital platform affordances, new solutions have been designed and seamlessly integrated into existing platforms to improve processes. Previously, the port was inundated with laborious and inefficient processes, and government agencies did not collaborate with each other. However, through digital platform affordances, new systems have been introduced to achieve distributed collaboration between actors. For example, formerly, an importer had to move between the various offices of the regulatory agencies to undertake clearing processes, as there was limited collaboration. However, through digital platforms, innovative systems have been developed to improve business processes. Currently, more government agencies have been integrated through new digital platforms like JIMIS. As a result, processes such as examinations that were done separately are now conducted jointly, thereby reducing processing times.

In addition to distributed collaboration, new digital services have been implemented as part of the affordances offered by digital platforms. For instance, new payment channels, such as mobile money and online banking have been introduced at the port. Therefore, declarants do not need to queue at the banks to make payments. A GCNet systems developer explained:

> *"... we have integrated new payment channels such as mobile money and online payment into the paperless era, so no queuing at the bank anymore..."*

This introduction of new digital services such as different payment channels was confirmed by a freight forwarder:

> *"... now you do not need to queue at the bank to pay for your duties, you can sit in your office and pay online."*

As part of the new digital services, the paperless reforms also saw the introduction of a risk management engine that rewarded compliant declarants by eliminating the need for physical examination of some consignments. Given that time is crucial in the port processes, this service of labelling consignments as green, yellow or red was hailed as a significant digital innovation in the port, as it enabled faster clearance of goods and less operational cost. An IT consultant of West Blue, a digital platform provider at the port, explained:

> *"... there is a risk management engine that uses three parameters (product being imported, process of clearance, people [organisation] doing the clearance) to determine if there is a need for physical examination based on the risk level."*

A Customs examination officer corroborated:

> *"When the scan report says the container is green, you only sight the content of the container without thorough inspection [...] under normal circumstances, we just have to let the container go without examining but we just want to check if the scan report matches what is in the container."*

Given that new digital innovations such as distributed collaboration, electronic payment and risk prediction tools are now possible, we believe that digital platforms have greatly spearheaded digital innovation at the port.

Improved value creation

Previously, the port was labelled inefficient and highly corrupt. However, with the deployment of digital platforms to streamline processes, significant gains have been made.

Although there are still avenues for improvement, overall value creation at the port has improved. As one importer alluded:

> "… things have greatly improved with the new changes and systems (digital platforms) in the port, […] we used to wait for several weeks to clear our goods, but now, in a few days, you can clear your goods."

Also, a freight forwarder interjected as follows:

> "… with the new paperless era, there is limited physical interaction with officials especially Customs officers since most processes are digitised. Also, if your container has a green channel risk assessment, there is no need for physical examination."

With new changes in the port such as digitisation, distributed collaboration and streamlined processes due to the deployment of digital platforms, there has been general improvement in value creation, the effect of which is also reflected in increased government revenue, as echoed by Ghana's Vice President:

> "The results are amazing. We just looked at the data this morning – first week of collections under the paperless system in September this year (2017) compared to last year first week of collections in September 2016 have gone up by 56 percent; 56 percent from around GHS130 million to GHS 213 million per week." (Citifmonline.com, 2017a)

This was corroborated by the Customs sector commandant of Tema Port:

> "…in terms of revenue, I can confirm that it has increased since the paperless began compared to the previous year".

While government has witnessed revenue increases, importers have also seen some reduction in their transaction costs at the port. They have enjoyed improved value, with less payment for demurrage and "facilitation fees" as clearance processes have become faster and are largely devoid of corruption. An importer explained:

> "With the paperless, we don't pay some "facilitation fees" as we used to pay previously because there are less physical interactions between officers and this has reduced our cost of operation in the port."

Thus, we view improved value creation in terms of increased government revenue and decreased operational costs as a transformational outcome, critical in leapfrogging the port's development.

5   Discussions

In this study, we addressed the research question: *"How can digital platformisation facilitate public sector transformation?"* Supported by technology affordance theory, our findings inspired the development of a transformational affordance framework (TAF) as shown in Figure 2. This TAF explains how the interaction between digital platforms and goal-oriented organisational actors generates relational affordances to enable digital transformation and produce transformational outcomes. While digital platforms have flexibility, modularity, and generativity (Nambisan, 2017; Yoo et al., 2010) as functional affordances, the needs of organisations differ. Thus, to leverage digital platforms for transformation, goal-oriented organisational actors need to interact with the technology for specific relational affordances to emerge and be realised.

Through actualisation of these relational affordances, transformational outcomes are achieved. For instance, generativity of digital platforms enable the recombination of components to extend and redistribute functionalities (Yoo et al., 2010). As such, digital platforms can be re-purposed to generate innovations and new affordances. Therefore, to achieve public sector transformation, organisations need to interact with digital platforms to generate relational affordances and achieve transformational outcomes. Based on the TAF and our findings, we offer four propositions on how digital platformisation can enable public sector transformation.
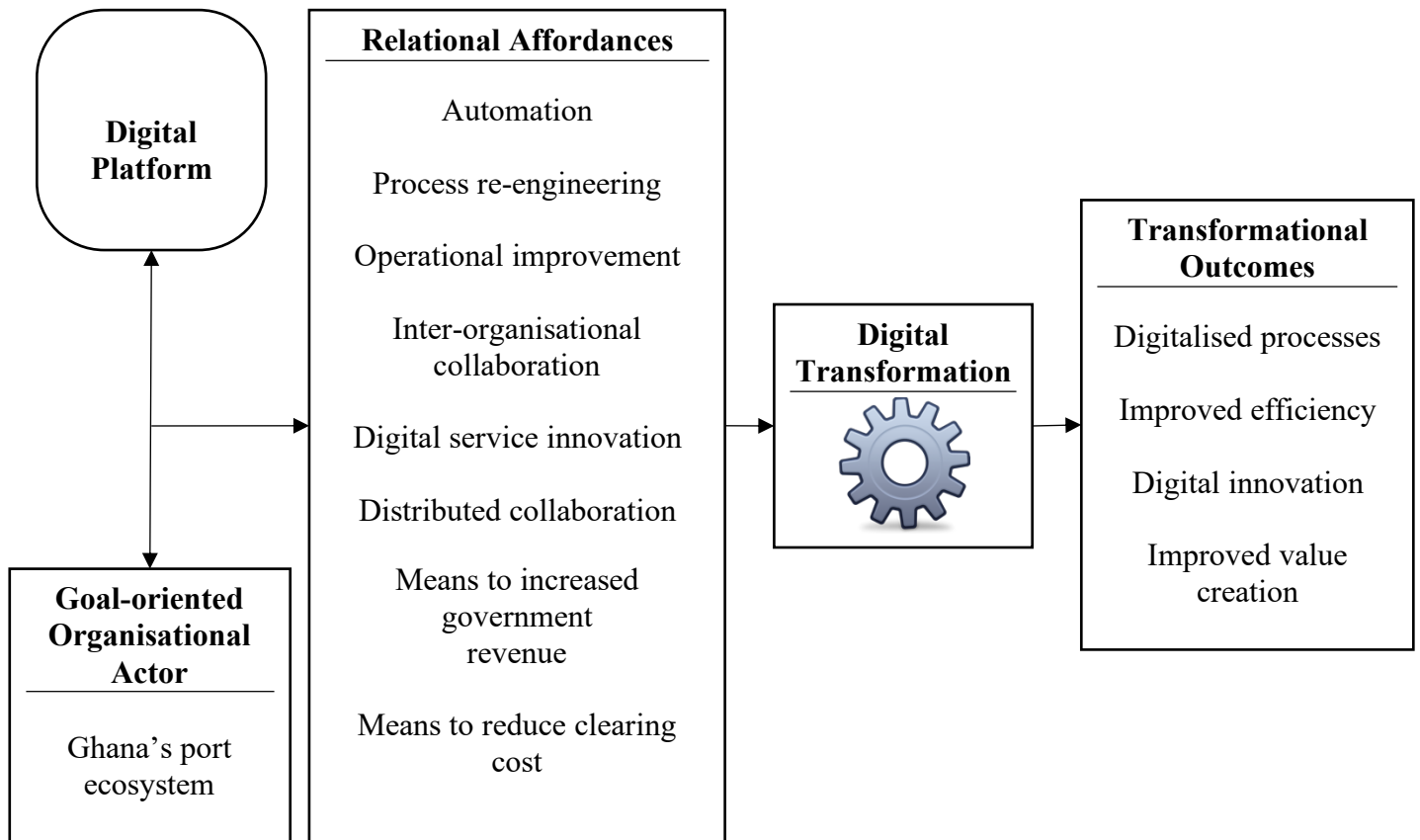
Figure 2. Transformational Affordance Framework (TAF)

Our findings and TAF explicate how a large public sector environment was transformed through digitalised processes involving automation and re-engineering into a digital ecosystem, comprising interdependencies between actors, technologies, and processes (Senyo et al., 2019b, 2019a). We note that the transformation led to reduction in redundant functions, bureaucracy, and duplication of work, as well as increased inter-organisational collaboration between government agencies. Similarly, the digitalised processes enabled changes in activities, processes, and programmes to accommodate emerging technological transformations from the pre-digitisation to the post-digitisation era. This confirms the assertion by Janssen and Estevez (2013) that digital platformisation is a viable strategy for public sector transformation. Therefore, public sector transformation requires nuanced integration of political reforms and organisational changes, accompanied by digitalised processes (Senyo et al., 2019a). Our findings affirm that the nature of the digitalised processes accompanying digital platformisation influences the outcomes of public

sector reforms (Brown et al., 2017; Ranerup et al., 2016) in less developed economies as well. We therefore propose that:

Proposition 1: *Digital platformisation and accompanying digitalised processes improve interdependencies between actors, technologies, and processes to facilitate public sector transformation.*

As presented in the TAF and supported by our findings, operational improvement together with increased inter-organisational collaboration enabled the removal of redundant functions and processes, duplication of work, and reduced bureaucracy. Improved efficiency is therefore a transformational outcome of digital platformisation. These changes also meant that the need for physical interaction between actors was minimised to the extent that it became more difficult to demand facilitation payments (bribes). Since actors can achieve desired goals through technology artefacts (Hutchby, 2001), public sector organisations can employ ICTs to improve internal and external processes to promote efficiency, transparency and accountability (Weerakkody et al., 2011). Improving efficiency, transparency and accountability ultimately leads to reduced corruption. Consequently, even in less developed economies which are often characterised by weak institutions and corruption (Amankwah-Amoah, 2016a; Osabutey and Croucher, 2018), digital platformisation has the potential to improve efficiency, transparency and accountability. We therefore propose that:

Proposition 2: *Digital platformisation has the potential to improve efficiency and reduce corruption to enhance public sector transformation.*

Our findings and the TAF reveal incremental innovation through digital platformisation strategies. The literature suggests that digital platformisation supports digital innovation within dynamic environments (Gupta and Bose, 2019; Nambisan et al., 2017). The port is a good example of a large, complex and dynamic public sector ecosystem (Senyo et al., 2019b). Digital platforms allow such organisations the flexibility to innovate in response to changes in their external environment (de Reuver et al., 2017). Our study demonstrates how existing digital platforms have been used to integrate processes within government agencies. In addition, new digital services such as distributed collaboration, electronic and mobile payments, risk management, etc. have been implemented. Evidently, digital platforms have greatly spearheaded innovations within the large

public sector organisation. Since digital platformisation motivated actors to rethink different elements of their operations to synchronise with the new technologies, resulting innovations were developed to address specific needs. The application of technologies to solve new problems is at the heart of innovation and can lead to the development of new technologies. This affirms that digital platformisation offers a medium for technology leapfrogging in public sector transformation (Binz et al., 2012). We propose that:

Proposition 3: *Digital platformisation can unleash incremental innovation with potential for technology leapfrogging in large-scale multifaceted and complex public sector transformation.*

Our earlier propositions and the TAF affirm streamlined operations, increased efficiency, reduced corruption, and enhanced incremental innovation, all of which reduce waste, time, costs, etc. thereby increasing profitability and creating added value. Many of the multiple actors observed reduction in costs. At the same time, government revenues also increased, leading to improved value creation for stakeholders. Therefore, the entire ecosystem has benefited from the improved value creation. In addition, digital platformisation gave impetus to unprecedented innovation, leading to actors continuously find ways to use information technologies to reduce costs and increase efficiency. This means changing organisational culture, processes, etc. within and between actors, aimed at improving public sector transformation. Therefore, public sector transformation through digital platformisation can lead to change in culture, processes, values, etc., akin to private sector customer-oriented approaches (Wiredu, 2012). Inadvertently, a high level of government efficiency can enhance technological adoption within the public sector (Osabutey and Croucher, 2018) to improve value creation. Therefore, digitalisation by public sector organisations can encourage stakeholders to adopt digitalised processes and innovate to increase efficiency, reduce corruption and improve value creation. We propose that:

Proposition 4: *Digital platformisation and the accompanying digitalised processes can increase efficiency, reduce corruption, and encourage innovation to improve value creation as an additional outcome of public sector transformation.*

5.1   Theoretical implications

Although prior studies (e.g., Gupta and Bose, 2019; Nambisan, 2017; Yoo et al., 2010) have highlighted digital platform affordances, there is limited understanding of how they can facilitate

public sector transformation. Our findings show that the interactions between digital platforms and goal oriented organisational actors give rise to relational affordances such as automation, process re-engineering and operational improvement to enable transformational outcomes in public sector transformation. For instance, due to the deployment of digital platforms, most physical processes that used to be avenues for corruption have been removed through digital platformisation. As a result, the port has realised transformational outcomes which otherwise would have been difficult to achieve. This indicates the importance of digital platformisation in public sector transformation.

Furthermore, our study points to how relational affordances are generated. Prior studies (e.g., Gupta and Bose, 2019; Tim et al., 2018) on technology affordance theory have largely focused on functional affordances. From our framework, it is evident that interactions between digital platforms and goal-oriented organisational actors give rise to relational affordances. For instance, our findings show that affordances such as automation, process re-engineering, inter-organisational collaboration, digital service innovation and distributed collaboration can emerge due to deployment of digital platforms. Therefore, our four propositions and the TAF demonstrate how organisational goals can be achieved by utilising digital platforms to derive relational affordances and create digital transformation which integrates digitalised processes, improving efficiency, innovation, and value creation. Given that the extant literature is currently limited on how interactions between goal-oriented organisational actors and digital platforms generate relational affordances, especially in public sector transformation, our study provides an alternative perspective that contributes to the technology affordance theory.

From the public sector transformation literature (Janssen and Estevez, 2013), calls have been made for the next wave of change. However, there is limited clarity on how to undertake this required transformation. While platformisation has been proposed as a medium for public sector transformation (Bygstad and Hanseth, 2018; Constantinides et al., 2018), there is limited knowledge on how this can be achieved. Through the findings of this study, we demonstrate how digital platformisation can facilitate public sector transformation. We further developed a framework (TAF) as a guide to public sector transformation. Given that the literature on platformisation of the public sector is currently limited, our study and the framework make a significant contribution. By going a step further to demonstrate how digital platforms facilitate public sector transformation, this study contributes to the digital platform and public sector transformation literature.

5.2 Practical and policy implications

Our study offers practical and policy implications. The findings emphasise how digital transformation can be used to enhance transparency in public sector administration. This is particularly important in less developed economies where poor public sector accountability gives rise to corruption. Indeed, monitoring and evaluation capability can be improved through digital transformational affordances which, inevitably, augment value creation by encouraging digital innovation to improve efficiency. This suggests that modern public sector transformation requires digital platformisation. Therefore, our findings have implications for ongoing digitalisation in the public sector globally and offer noteworthy practical implications.

First, our framework provides a practical guide to other public sector organisations venturing into digital platformisation. Second, the study provides examples of possible outcomes that public sector organisations can obtain from platformisation. Given the need for value-for-money assessment in public sector projects, this study provides results that could be useful during planning and evaluation stages. Policymakers need to evaluate the costs and benefits of digital platforms and then use lessons learned from our case study. Public sector organisations need to adopt appropriate digital platforms to improve service quality, revenue mobilisation, automation, value creation, and transparency. Our study creates room for further studies to evaluate the policy implications of digital platform affordances as engines for public sector transformation.

6 Conclusion

This study investigated how digital platforms facilitate public sector transformation. The findings from the study and the theoretical lens of technology affordance theory led us to develop the TAF which depicts how digital platforms facilitate public sector transformation. The TAF, as the main contribution of this study, suggests that the interactions between digital platforms and goal-oriented organisational actors generate relational affordances to enable digital transformation and produce transformational outcomes. In addition, the findings show four transformational outcomes that digital platformisation enables in the public sector. To date, there has been limited knowledge on how digital platformisation facilitates public sector transformation. Thus, through our framework, this study contributes to both digital platformisation and public sector transformation research.

Our study provides insightful perspectives to enrich the literature on public sector digital platformisation strategy from a less developed country context. However, the study is limited by focusing solely on one public sector environment in a single less developed economy. Addressing research gaps in the literature, this focus also reveals a lacuna in the knowledge regarding how digital platformisation strategy is used in private sector transformation in less developed economies. Since the institutional voids affect public and private sector organisations differently, future studies might focus on the private sectors in less developed economies and may also consider multi-country studies. Longitudinal studies could enhance our understanding of how digital platformisation strategies in less developed countries evolve over longer periods of time. A comparative public-private sector study would also be enlightening. In addition, future research could validate the TAF in other less developed economies.

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Appendix A: Data sources

Primary data collection (37 interviews)				
Interviewees	**Title**	**Role**	**Years of Experience**	**Number of Interviews**
Customs	Assistant Commissioner	Commandant of Tema Port	28 years	2
	Assistant Commissioner	Director of Systems at Tema Port	25 years	3
	Senior Collector	Compliance Officer	22 years	1
	Senior Collector	Head of REEFER Yard	25 years	2
	Principal Collector	Deputy Head of REEFER Yard	36 years	1
	Principal Collector	Head of Safe Bond Yard	29 years	2
	Assistant Collector	Valuation Officer	5 years	3
	Assistant Collector	Preventive Officer	2 years	1
	Senior Collector	Examination Officer	15 years	1
	Collection Assistant Class1	Examination Officer	12 years	1
GPHA	Senior Public Relations Officer	Public Affairs	20 years	3
West Blue	IT Consultant	Technology Solution Provider	3 years	2
GCNet	Systems Developer	Technology Solution Provider	5 years	2
Freight Forwarders	Senior clearing Agents	CEO of a freight forwarding company	32 years	2
	Senior clearing Agent	CEO of a freight forwarding company	13 years	1
	Senior clearing Agent	CEO of a freight forwarding company	17 years	1
	Senior clearing Agent	Senior freight forwarder	9 years	1
	Senior clearing Agent	Senior freight forwarder	13 years	2
	Junior clearing Agent	Clearing Agent	4 years	1
	Junior clearing Agent	Clearing Agent	3 years	1
	Junior clearing Agent	Clearing Agent	2 years	1
	Junior clearing Agent	Clearing Agent	3 years	1
Importers	Vehicle importer	Owner of a vehicle dealership	5 years	1
	Vehicle Importer	Owner of a vehicle dealership	2 years	1
Secondary data sources				
Ghana Revenue Authority Port Process Manual	https://www.ghanastradinghub.gov.gh/new/Content/Frontend/light/img/sections/Documents/Process%20Manual.pdf			
News websites	http://citifmonline.com			
	https://www.myjoyonline.com			
	https://www.ghanaweb.com			
	https://www.graphic.com.gh			
	http://citibusinessnews.com			
Official port websites	https://ghanaports.gov.gh			
	https://www.ghanastradinghub.gov.gh			
	http://www.ghanasinglewindow.com			
	https://eservice.gcnetghana.com			
Reports	De Wulf (2005) - World Development Report – TradeNet in Ghana			
	Achieving Port Efficiency and Paperless Clearance in Ghana			
	Recommendation and Guidelines on establishing a Single Window			

Appendix B: Main and sub-themes

Transformational Outcomes	Second Order Themes	First Order Quotes	Quotes from Supporting Secondary Data Sources
Digitalised processes	Automation	"Paperwork has drastically reduced; now you do more of the processing on the computer by submitting electronic document" (Freight forwarder)	"Two people were able to make their online request which the Port Authority's operational team were able to respond to and served appropriately" (Myjoyonline.com, 2017)
		"We used to submit multiple copies of document to different regulatory agencies but with the paperless you just need to submit one copy of the document online and that's all" (Freight forwarder)	"Lots of paper work is involved, multiple copies are required, and the transcription is error prone" (De Wulf, 2005)
	Process re-engineering	"There is no 'long-room' in the paperless era, compliance officers are based at a secure location at the headquarters […] agents cannot talk to them directly as they used to do previously" (Commandant of Tema Port)	"Ultimately every compliance officer will leave Tema in actual fact as the directive from the Vice President indicates that the Long Room will cease to exist" (CitiBusinessNews.com, 2017)
		"… now that there is paperless, the Customs officer gets notification of declaration assigned to him/her instead of paper documents" (Head of Systems at Tema Port)	"Excellent drive by the Vice President to champion the implementation of the 100% paperless regime at the Port to ensure transparency and efficiency" (GCNet, 2018)
		"… in the paperless, declarants do not need to come to our [GPHA] revenue centre to print waybills and invoices, everything is now online…" (GPHA officer)	"The single window is an electronic system when you hook on you can release a cargo when you realize that that has conform which means you do not have to be physically present to examine the cargo which will reduce the congestion at our ports" (Citifmonline.com, 2017b)
Improved Efficiency	Operational Improvement	"Now the number of regulatory agencies required to do inspection has reduced, processes have improved and things are faster …" (Customs Head of Systems)	"…some clearance which normally would have taken two weeks and about 28-32 stages were reduced to a day with only 8 stages" (De Wulf, 2005)

Transformational Outcomes	Second Order Themes	First Order Quotes	Quotes from Supporting Secondary Data Sources
		"Previously, importers had to submit the application on GCMS and still print on paper for us [compliance officers] to verify, now that we don't have paper, we only use the documents uploaded electronically making the process faster because there is less distraction from agents" (Customs Compliance Officer)	"The declarant presents himself with supporting documentation (printed declaration, invoice, certificate of origin, DIS certificate, etc.) either the Document Verification Section or the CEPS Compliance Office of the clearance point …" (De Wulf, 2005)
	Inter-organisational Collaboration	"Now with the paperless, whoever is delaying will be known so things are moving faster than before" (GPHA)	"On September 1, we launched the paperless [system], but of course not without attempts to actually derail the process, because it's hurting a lot of people who were making free money and people who used to take two weeks to clear a container after one day of delay were protesting system or something else?" (Citifmonline.com, 2017c)
		"When the scan report says the container is green, you only sight the content of the container without thorough inspection […] under normal circumstances, we just have to let the container go without examining them but we just want to check the scan report matches what is in the container" (Customs examination officer)	"…. digitization drive has led to a drastic reduction in clearing and turn-around times at the country's ports through the introduction of a Paperless Port system" (GhanaWeb.com, 2020)
Digital innovation	Distributed collaboration	"… because of the JIMIS, now inspection is done jointly, all the agencies mandated to inspect a consignment all get a notification when a terminal operator allows the schedule [inspection] … instead of individual inspection, only one inspection is done jointly" (West Blue)	"…a joint inspection by all regulatory agencies at the ports and a hundred percent paperless transactions at the ports" (Myjoyonline.com, 2017)
	Digital service innovation	"… we have integrated new payment channels such as mobile money and internet banking into the paperless era, so no more queuing of at the bank to make payment" (GCNet)	"Similarly, we expect that the ePayment and eManifest systems will have a strong positive impact on the trade

Transformational Outcomes	Second Order Themes	First Order Quotes	Quotes from Supporting Secondary Data Sources
			processes" (Ghana Revenue Authority, 2016)
		"… there is a risk management engine that uses three parameters (product being imported, process of clearance, people [organisation] doing the clearance) to determine if there is a need for physical examination based on the risk level" (West Blue)	"West Blue Consulting is getting ready to take over the Classification, Valuation and Risk Management functions from the Destination Inspection Companies (DICs) at the Ghana's ports as government has directed the DICs to hand over" (Citifmonline.com, 2015)
Improved value creation	Means to increase government revenue	"…in terms of revenue, I can confirm that it [revenue] has increased since the paperless began compared to the previous year" (Customs Commandant at Tema Port)	"Total import revenue realised for half year 2015 was GH¢3.6 billion. This, however, increased to GH¢4.3 billion by June 2016. The figure further increased from GH¢4.3 billion in June 2016 to GH¢5.3 billion in June 2017. For the first half of this year, about GH¢5.8 billion has been collected for the state from importers" (GraphicOnline.com, 2018)
	Means to reduce clearing cost	"… in this paperless [era], we don't pay some of the usual "facilitation fees" [bribes] because we don't meet officers physically…" (Freight forwarder)	"The Customs, on Monday, September 4, 2017 reduced its staff stationed at the Long Room of the Tema Port following the start of the paperless clearing system. This was among others expected to reduce the human interface and corruption associated with the former clearing process" (CitiBusinessNews.com, 2017)