The African Journal of Information Systems

Volume 13 | Issue 2 Article 1

May 2021

Emergence and Constraints of Enterprise Platform Silos for Online Interactions: A Case Study from Ghana Before and During Covid-19

John Effah
University of Ghana Business School, jeffah@ug.edu.gh

The African Journal of Information Systems

Emergence and Constraints of Enterprise Platform Silos for Online Interactions: A Case Study from Ghana Before and During Covid-19

Research Paper

Volume 13, Issue 2, May 2021, ISSN 1936-0282

John Effah
Department of Operations and Management Information Systems
University of Ghana Business School
jeffah@ug.edu.gh

(*Received January 2021, accepted March 2021*)

ABSTRACT

The purpose of this study is to understand the emergence and constraints of enterprise platform silos for online interactions at the organizational level. Information systems (IS) research has focused more on external platforms without silos. As a result, not much is known about internal platforms and silos at the organizational level and how they constrain online interactions, especially in the developing economic context of Africa. This study follows an interpretive, qualitative case study methodology and the encounter-episode process model to investigate the case of using enterprise platform silos in an organization in Ghana, before and during Covid-19. The findings show how failure to modernize the installed-based platforms, integrate platform portfolios, use enterprise architecture, and build internal competence for platform integration leads to silos. Identified constraints include challenges with information sharing and transfer between platforms, manual intervention with delays and errors, and multiple sign-ins with different password formats per user.

Keywords

Digital platform, enterprise platform, silo, online interaction, interpretive case study, encounter-episode, Africa, Ghana

INTRODUCTION

Online interactions enable people to communicate and collaborate without the need for face-to-face contact. Such interactions through online platforms have become even more important in Covid-19 with its physical and social distancing requirements to prevent the spread. As online hubs, digital platforms enable online interactions between individuals and among groups (De Reuver et al., 2018; Grover, 2019; Spagnoletti et al., 2015) in geographically dispersed environments. Before COVID-19, digital platforms were used mainly by online organizations (Grover, 2019; Tumbas et al., 2017) such as Amazon, eBay,

and Uber for business transactions (Hagiu, 2014; Ter et al., 2016). Following COVID-19 and its distancing requirements, traditional organizations, including universities, have been compelled to deploy digital platforms for online interactions for their internal and external stakeholders.

In terms of architecture, a digital platform comprises a stable core module, flexible complementary applications as add-ons, and interfaces that connect the two (Constantinides et al., 2018; Tiwana et al., 2010). In relation to organizations, digital platforms can be classified into two categories as internal (enterprise) (Tormer, 2018) or external (supply chain and industry) (Ghazawneh & Henfridsson, 2015; Hagiu, 2014). Internal platforms, such as enterprise resource planning systems (ERP) and customer relationship management systems (CRM), are used by individual organizations (Tormer, 2018) for their internal members and immediate partners such as customers and suppliers. Conversely, external platforms such as those provided by Amazon, eBay, and Airbnb have a larger focus at the industry and/or supply chain levels (Ghazawneh & Henfridsson, 2015; Hagiu, 2014; Ter et al., 2016).

Over the years, information systems (IS) research on online interactions via digital platforms has focused more on external platforms (Tormer, 2018) with seamless interfaces between their core modules and complementary applications. As a result, the dominant position in the literature is that digital platforms have seamless interfaces and therefore are without silo system challenges. Consequently, the use of digital platforms has been identified as the solution to silos as systems with disparate, unintegrated, and multiple applications (Bygstad et al., 2015). Yet, some large organizations are prone to silo systems because of their dependency on multiple solutions from different vendors to meet different stakeholder needs (Bygstad & Hanseth, 2018; Vestues & Knut, 2019). Thus, limited research exists on enterprise platform silos and their constraints on online interactions at the organizational level, especially in the developing economic context of Africa. Thus, the need exists for more research into such an area, especially in Covid-19, when digital platforms for online interactions have increasingly become important for people to maintain physical and social distance between themselves.

With this knowledge gap, this study seeks to understand the emergence and constraints associated with enterprise platform silos. Therefore, the research question motivating this study concerns why enterprise platform silos emerge and how they constrain online interactions. To address these questions, this study follows the encounter-episode process model (Newman & Robey, 1992; Robey & Newman, 1996) as the theoretical lens and interpretive, qualitative case study (Myers, 2013; Walsham, 1995, 2006) as the methodology to investigate the case of using enterprise platform silos in a higher education institution in Ghana, C-Uni (pseudonym), within the context of Africa. The institution was chosen because of its use of enterprise platform silos and their effects on its stakeholders' needs for online interactions before and during Covid-19.

The rest of the paper is organized as follows. It begins with a review of the literature on system silos, digital platforms and Covid-19. Then, the encounter-episode framework is presented as the theoretical lens for the study. This is followed by sections that present the research setting, methodology, case results and discussion. The paper concludes with its contribution, limitations, and direction for future research.

LITERATURE REVIEW

Silo Systems

Silo systems work without connection with other systems (Bannister, 2001; Bygstad et al., 2015). As stand-alones, they lack integration and hence do not support data sharing and collaboration in organizational contexts (Bygstad et al., 2015). Traditionally, silo systems were implemented to meet information needs of specific individuals or organizational units in line with the division of labour (Bygstad & Hanseth, 2018). The architecture of silo systems is based on a tightly coupled database, business logic, and user interfaces (Bygstad & Hanseth, 2018; Bygstad et al., 2015). Therefore, their use creates portfolio of disparate applications across organizational units (Bygstad & Hanseth, 2018). According to Bannister (2001), silo systems were never intended by organizations; such systems only emerged in the attempt to meet the needs of individual organizational units. As Bystad et al. (2015) point out, organizations did not intentionally call for silo systems. Rather, the concept of silo emerged when people realized its constraints on enterprise integration.

From the narrow individual unit perspective, silo systems offer some advantages. They are capable of meeting specific information needs (Bannister, 2001; Bygstad & Hanseth, 2018), and of supporting stable individual system architecture (Bygstad et al., 2015) and the division of labour and organizational hierarchies. Other benefits include supporting structured decision-making, their ease of use, and allowing change at the organizational unit level (Bannister, 2001; Bygstad et al., 2015). However, from the broader enterprise integration perspective, silo systems present several challenges. They constrain cross-functional collaboration (Kahkonen et al., 2017) between departments and external partners (Bygstad et al., 2015). They also prevent information sharing by locking data into disparate databases (Hannila et al., 2019). Also, silo systems are expensive to run, cause work duplication and reduce trust among organizational actors (Demirkan et al., 2008). In addition, their non-internet client-service network architecture constrains online interactions (Bygstad et al., 2015), which have become important for Covid-19 social distancing.

Calls have therefore been made to break silo systems through integration for enterprise-level collaboration (Tsang-Kosma, 2010). Initial attempts to use enterprise systems (Devadoss & Pan, 2007; Pollock, 2004; Wagner & Newell, 2004) to resolve the problem faced some challenges. Their complex architecture, rigid design, and client-server network infrastructure (Pollock, 2004; Rosemann & Watson, 2002) had the tendency to cause vendor lock-ins to prevent enterprise-wide collaboration (Bygstad et al., 2015). In recent years, digital platforms have been identified as the appropriate solution (Bygstad & Hanseth, 2018; Vestues & Knut, 2019) to silo system problems for online interactions. As noted by El Sawy et al. (2016), the need has come for organizations to go beyond traditional enterprise systems to promote online integration and collaboration. However, Bygstad et al. (2015) point out that using digital platforms to break down silos alone is not enough; efforts should be made to align the platforms with organizational competences, processes and culture (Bygstad et al., 2015).

For information systems (IS) research in Africa, silo systems have attracted some attention from the health sector. In Morocco, Parks et al. (2019) identified repeated errors, lack of interoperability and collaboration as well as insufficient human and financial resources as some of the key challenges with silo systems in the health sector. The authors called for the need to address the problems with silo systems in Morocco and other developing economies. In Namibia, Dlodlo and Hamunyela (2017) found the lack of coordination and duplication of functions with silo systems in the health sector as a key challenge. They therefore called for system integration across the sector to ensure consistent information delivery. In Ghana and Guinea Bisau et al. (2016), identified silo systems with disparate reporting

channel challenges within the national health system and recommended a unified architecture to address the problem. Besides the health sector, Akaba et al. (2019) pointed out the lack of integration as the problems with silo systems in Nigeria's public procurement and recommended adoption of blockchain technology to address the silo system-induced problems in the sector. From the extant literature, existing IS research in Africa has mainly been at the sector or industry level, particularly in health and to some extent national procurement. Thus, the need exists to look at the organizational level and other sectors. Hence, the current study is focused at the organizational level to understand enterprise platform silos and problems with online interactions, especially in relation to Covid-19 social distancing requirements.

Digital Platforms

The capability of digital platforms to address silo system problems has been discussed in the IS literature (Bygstad & Hanseth, 2018; Vestues & Knut, 2019). A digital platform has a layered modular structure (De Reuver et al., 2018; Kannan, Mathew, & Lehner, 2019; Tiwana, 2015; Yoo, Henfridsson, & Lyytinen, 2010) with a stable core module, dynamic complementary application modules and interfaces that connect the core to the applications (Tiwana, 2015; Tiwana et al., 2010; Yoo, Lyytinen, et al., 2010). The interfaces are enabled by standardized application programming interfaces (APIs) (Constantinides et al., 2018; De Reuver et al., 2018) to facilitate seamless integrations among multiple applications (Mini & Widjaja, 2019). For this reason, the complementary applications are designed to be loosely coupled and flexible (Tiwana, 2015; Tiwana et al., 2010) while the platform core remains stable. As a result of this architecture, the platform core enables add-ons of complementary applications for data and information sharing among multiple user groups (Tormer, 2018; Yoo et al., 2012). As a result, unlike silo systems, digital platforms facilitate online interactions without the need for face-to-face or physical contacts (Saarikko, 2015).

Digital platforms can be external or internal to organizations (Gawer, 2014; Gawer & Cusumano, 2014). External platforms constitute external supply chain or industry-level ecosystem hubs (Gawer, 2014). Conversely, internal platforms (Gawer, 2014), also called enterprise platforms (Hanseth & Bygstad, 2018; Tormer, 2018; Tormer & Henningsson, 2020), enable online interactions among organizational members and partners. Thus, internal digital platforms help to address problems with system silos (Vestues & Knut, 2019) and enterprise systems. As a result, platforms are believed to be solutions to silo systems. However, their stable core module architecture has been criticized for constraining innovation of the installed base (Baldwin & Woodard, 2009; Bygstad & Hanseth, 2018) and creating tensions for stability and change (Bygstad & Hanseth, 2018). To overcome this problem, infrastructuring, as the process of continuous evolution and scaling of the platform core (Tumbas et al., 2017) alongside platformization of complementary applications (Constantinides et al., 2018), has been proposed as the solution.

Generally, IS research on digital platforms has focused mainly on the external with less attention paid to the internal or the enterprise platform (Tormer, 2018). As noted by this author, internal platforms are important for organizations to address the problem of silo systems for heterogeneous user groups and functional units. Therefore, the need exists for empirical research on enterprise platforms and silos. Also, digital platforms research specifically focusing on Africa remains limited with few exceptions. From South Africa, Kamanga and Matthews (2020) investigated platforms and power dynamics between job seekers and employers. The authors note how digital platforms can enhance the power and dignity of marginalized workers by preventing unfair treatment from potential employers. In Ghana, Senyo et al. (2021) investigated digital platformization from paper-based systems in a seaport. The findings show the importance of digital platforms to improve collaboration, efficiency and transparency while reducing

corruption and duplication of functions. Also in Ghana, Renner-micah et al. (2020) studied institutional effects on national health insurance digital platform development and use and found the contribution of mobile penetration towards increasing adoption of digital platform in the health insurance sector. The above review shows an existing research gap on enterprise platform silos and online collaboration in general and in Africa in particular, hence the need for the current study.

COVID-19 and Digital Platforms

According to Sein (2020), "the Covid-19 pandemic has essentially forced us deep into the digital world". To enforce its social distancing requirements, organizations are adopting digital platforms to work from home or remotely in place of working from physical offices (Barnes, 2020). Thus, with digital platforms and online interactions, organizational members (employees and management), as well as partners (consultants, customers, and suppliers) can avoid face-to-face contacts to prevent the spread of the disease. Following Covid-19 and the various lockdowns, adoption of digital platforms has become increasingly pervasive across sectors and industries. In education, several universities have adopted digital platforms for online teaching and learning in place of the in-person classroom interaction (De, Pandey, & Pal, 2020). In e-commerce, the use of digital platforms for online selling and buying has grown due to Covid-19, especially during the lockdown periods (Barnes, 2020). For work, several organizations and their employees have adopted digital platforms for working from home or remote locations (Carroll & Conboy, 2020; Richter, 2020). It is expected that digital platform use for online interactions, work, and services will continue even after Covid-19 (Barnes, 2020). However, intensive use of digital platforms for online interactions would require stable and reliable digital infrastructure and operations (Papadopoulos et al., 2020).

Covid-19 has made digital platforms important for online interactions to avoid direct, physical or face-to-face contacts (Barnes, 2020; Kodama, 2020; Richter, 2020). Under Covid-19, digital organizations continue to use digital platforms for online operations; non-digital organizations need to platformize their activities and interactions to enable social distancing (Effah, 2020). As a transformation process, digital platformization enables organizations to migrate from physical to virtual offices for online interactions (Bygstad & Hanseth, 2018; Tormer, 2018). Thus, digital platformization presents opportunities for non-digital organizations to avoid face-to-face interactions to prevent the spread of Covid-19. As noted by some authors (e.g., De et al., 2020; Richter, 2020), under Covid-19 social and physical distancing is not a choice but a requirement for the survival of people and organizations.

Since 2020, the subject of Covid-19 and digital platforms has been attracting research in IS (e.g., Barnes, 2020; De et al., 2020; Papadopoulos et al., 2020). Among the industries and sectors that have begun to attract much interest are: education, e-commerce, healthcare, and government services (e.g. Barnes, 2020; Doyle & Conboy, 2020; Fletcher & Griffiths, 2020). Given the novelty of Covid-19 and digital platforms, most of the papers have been conceptual. Thus, so far, less empirical studies exist on Covid-19 and digital platforms. The main issues discussed in the limited literature from developed economies are the organizational use of digital platforms for working from home and online services (Fletcher & Griffiths, 2020). In addition, the existing focus has largely been on stable and uniform digital platforms. The situation could be attributed to focusing on a single or one ecosystem platform rather than platform portfolios at the organizational level. Thus, given the limited focus on digital platforms and Covid-19 in multiple platform silo environments, especially in Africa, the need exists for this study on emergence and constraints of enterprise platform silos for online interactions, before and during the Covid-19 pandemic.

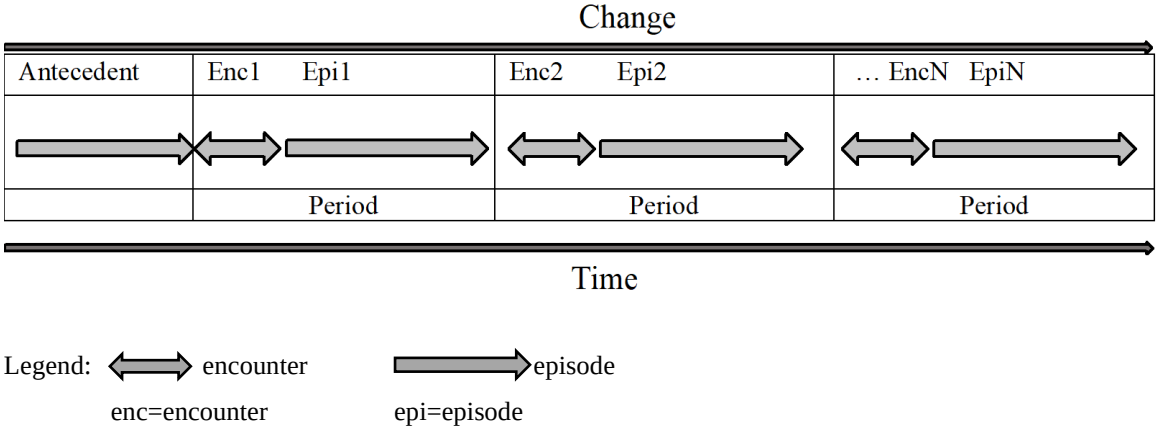
THEORETICAL FOUNDATION: ENCOUNTER-EPISODE PROCESS MODEL

The theoretical foundation for this study is the encounter-episode process model (Newman & Robey, 1992; Robey & Newman, 1996). This theoretical framework seeks to explain changing and relatively stable events in IS processes. The model separates IS processes into encounters as change events and episodes as relatively stable periods (Holmstrom & Henfridsson, 2006). The framework emerged from the punctuated equilibrium theory (Gersick, 1991) in evolutionary biology, which views change as alternating between longer periods of stability and shorter periods of revolution (Lyytinen & Newman, 2008). The fundamental concepts of the encounter-episode framework are antecedent conditions, encounter, and episode, as shown in Figure 1.

Antecedent conditions are situations that precede an observed change. They describe the existing or historical context until an initiative or a significant change in an organization, work process or technology occurs. As shown in Figure 1, the antecedent conditions serve as the background or the initial installed base before a change is introduced. In this study, the antecedent conditions constitute the situated use of the initial enterprise platform before another platform was introduced.

Figure 1

Encounter-Episode Framework



Note. Adapted from Silvis and Alexander (2014, p. 17) and Holmstrom and Henfridsson (2006, p. 10)

Encounters are events that mark changes in the status quo and thus usher in new situations, different from the existing one. Encounters are usually short periods of change events that transform the existing situation. Such events initiate a change in the antecedent or existing conditions to generate a new situation. As shown in Figure 1, encounters are the periods that mark the transition from existing situations to a longer period of stability. For this study, encounters introduce new digital platforms to change the antecedent and subsequent platform mix.

Episodes refer to the stable periods of activities until another change or encounter occurs. From Figure 1, the shorter periods are encounters, which separate episodes. For IS development and use, an encounter will be the shorter project period of system development and/or implementation while the longer periods represent stable uses until a new system is introduced. For this study, episodes are the stable periods of using existing platforms until new ones are introduced as encounters to change the status quo.

The fundamental principles of the theoretical framework are that episodes are longer duration events that mark the beginning and the end of various encounters, and are relatively longer periods of stability (Augustsson et al., 2019). While the original theory focused on IS development projects, subsequent applications have extended it into general IS phenomena such as community uses and relationships with developers (Holmstrom & Henfridsson, 2006). It has also been adapted to study the dynamics between control and drift in the management of digital infrastructure service portfolios (Augustsson et al., 2019).

This study applies the encounter-episode framework as a theoretical lens to analyze the emergence, uses, and problems with platform silos in an organizational environment. The theory is considered appropriate given that the various platforms in the case organization were sequentially introduced, with each introduction (encounter) resulting in an additional silo.

RESEARCH SETTING AND METHODOLOGY

Research Setting

The study focuses on the emergence, use, and problems with digital platform silos in an organization in Ghana, a developing economy located on the West Coast of Africa. As in similar African countries, the enterprise software industry in Ghana is limited in meeting the needs of large organizations, including higher education institutions with complex units and processes. As a result, large organizations on the continent of Africa depend on foreign developed software from the United States, Europe, and Asia. With foreign developers and vendors, it is often difficult to get a single enterprise platform that meets the needs of such organizations.

Thus, large organizations in Africa are often forced to use portfolios of enterprise platforms from different vendors with different generations at any point in time. Such was the situation with C-Uni (pseudonym), the case organization. Over the years, C-Uni has relied on a portfolio of platform silos for administration (admin), course management, and intranet from different vendors. In 2020, the organization was forced to add a video conferencing platform for teaching and learning as well as meetings to meet the COVID-19 social and physical distancing requirements. This case was considered important for research due to the siloed nature of its platform environment, the need to meet the information needs of varied stakeholders and units over time, and the challenges encountered for online interactions among the stakeholders.

Methodology

The research methodology is a qualitative, interpretive case study (Klein & Myers, 1999; Walsham, 1995, 2006). Qualitative research gathers data in the form of texts from varied sources such as interviews, observations and documents (Conboy & Fitzgerald, 2012) to seek in-depth understanding of a phenomenon within its context (Myers, 2013). The interpretive paradigm views research phenomenon and knowledge creation as subjective and therefore emergent from social interactions between researchers and their participants (Orlikowski & Baroudi, 1991). Generally, the qualitative case study approach investigates a research phenomenon in its real-life social context (Myers, 2013). Interpretive case studies in IS therefore seek to understand a research phenomenon as inter-subjective constructions within a socio-technical context (Walsham, 1995, 2006). The interpretive approach was chosen as most appropriate for understanding how enterprise platform silos emerge and the problems associated with their use for online interactions.

Data Collection and Analysis

Data collection occurred over a five-year period from 2016 to 2020 as part of a larger research project on digital platforms and business integration in Ghana. Following interpretive practices, the researcher gathered data from multiple sources, namely interviews and documents. Interviews were based on a semi-structured guide that was flexibly designed to account for emerging issues from the fieldwork. The interview guide covered participants' experiences and knowledge with the introduction and use of the various platforms before and during Covid-19. Purposive sampling (Patton, 2002) was used to select interview participants as follows: information technology (IT) staff (13), administrative staff (32), faculty members (32), and students (43). Additional data came from documents, including project reports, memos, and circulars as well as user and technical documentation.

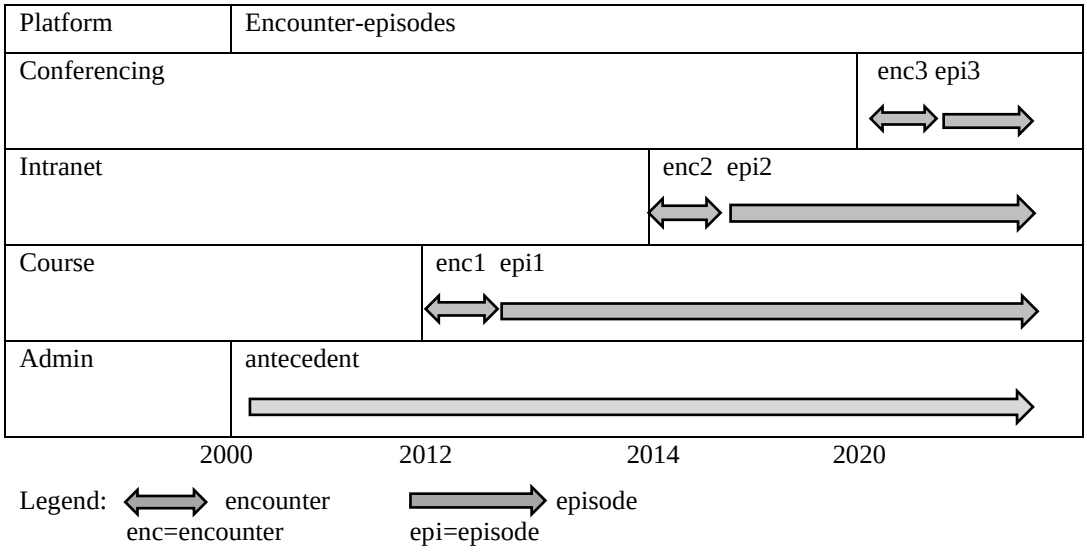
Based on interpretive, iterative research processes (Myers, 2013; Walsham, 1995), the analysis occurred alongside the data collection. In relation to the theoretical foundation, the analysis was driven by the encounter-episode process model as a lens. From the interpretive perspective, the intention was not to test the theory but draw from its concepts and principles to make sense of the data. The process involved identifying events related to antecedents, encounters and episodes. The concept of installed base was used to identify the antecedent as the initial platform before a second one was introduced for the silo situation to emerge. Subsequently, the concept of encounter was used to identify introductions of subsequent platforms as new encounters and their relatively stable use periods as episodes. Nonetheless, in line with the hermeneutic circle (Klein & Myers, 1999), the data analysis process was not linear but iterative and thus involved relating encounter-episode components as the parts and the interaction among them and their context as the whole. The results of the analysis are as presented in Figure 2 and elaborated on in the next section.

RESULTS

This section presents the results of the case analysis based on the encounter-episode process model as the analytical lens. Figure 2 shows the antecedent, encounters, and episodes of C-Uni's enterprise platform silos over time, from 2000 through 2012 to 2020 and beyond.

Figure 2

C-Uni's Silo Platform Antecedent, Encounter and Episode Processes



From Figure 2, the admin platform and its use constitute the antecedent condition from 2000, before any other platform was introduced to create a silo situation. However, its use has continued to date, alongside the other silo platforms. In 2012, the course platform was introduced (enc1); its use (epi1) created the situation of two platform silos, alongside the AP platform.

In 2014, the intranet platform was also introduced (enc2); its use (epi2), alongside the admin platform and the intranet platforms, led to the situation of three platform silos. Again in 2020, following COVID-19 and its distancing requirements, the conferencing platform (Zoom) was introduced (enc3); again, its use (epi3) alongside the admin, course, and intranet platforms, resulted in the situation of four silos. The subsections below elaborate on the antecedent, encounters, and episodes in the C-Uni platform silo environment.

Antecedent Conditions: Admin Platform as the Installed Base

The admin platform is proprietary and online application software, which was implemented by the vendor in the early 2000s. Table 1 shows the modules implemented for online actions and interactions as well as the intended user groups and uses. As shown in Table 1, the core modules for the admin platform were course administration, human resource, and accounting. The table also shows the target user groups for these modules and the expected online activities.

In practice, the admin staff have been using the course module to set up courses for students to register online. The staff also use the module to link courses to faculty members for online entry of examination results at the end-of-the semester. As a result of this setup, the course admin module constrains online interactions between students and faculty members. Moreover, the contact information (e-mails and phone) of students captured into the admin platform module is never accessible to faculty members to enable online interactions while the module has no functionality for such interactions. Thus, except for entering examination results at the end of the semester, faculty members have no access to student data for their activities.

Table 1

Admin Platform Modules, User Groups, and Uses

Modules	User Groups	Uses
Course admin	admin staff, faculty members, and students	• Admin staff: manage online data on courses, students and faculty members • student: register and view results online • faculty members: enter examination results online
Human resource	human resource staff and faculty members	• human resource staff: manage data on appointments, promotions, leave, and retirement • faculty members: view personal records online

Modules	User Groups	Uses
Accounting	accounting staff	• accounting staff: manage financial transactions, payroll and assets

On this, one faculty member complained as follows:

> *to be frank with you, it is always frustrating. We have no way to contact students outside the classroom; we also have no data on students to make necessary decisions such as how many photocopies of course outlines to make for distribution at the beginning of the semester. I don't understand this because the students register online, the data is captured and we need the information to prepared according to the number of registered students. Yet, I don't have access to such information. Why would the data be collected and be hidden from those who need it to do their work? I can't understand.*

The human resource staff use the human resource module to capture employee (faculty members and staff) data and related activities such as recruitments, appointments, promotions, leave and retirement. However, the actual activities occur through face-to-face interactions and paper-documents. Moreover, employees had limited access to their personnel data. They are also unable to update their records online without the need to complete paper documents and walk to physical offices to submit paper forms. Thus, all situations of personal records updates require face-to-face interactions and paper-documents. On this, one employee complained as follows:

> *We don't even have online access to update our records or alert human resource staff to make changes when our situation changes. They make us fill paper forms instead of updating the information online. Using paper forms in this IT age is frustrating and time consuming.*

Finally, accounting staff use the accounting module to manage financial data on transactions, assets, payroll, inventory and budgeting. Again, related actions and interactions occur through face-to-face and paper-based contacts.

Encounters and Episodes

Encounter 1: Introducing a Course Platform

Encounter 1 involved the introduction of the course platform in 2012. The course platform is an online, open source system. The aim was to enable online interactions between students and faculty members for teaching and learning. Before then, all interactions between faculty members and students occurred through face-to-face classroom environments and paper document exchanges (books, notes and photocopies). The course platform was therefore an innovation to promote online interactions for teaching and learning. However, the purpose was not to replace the existing face-to-face contacts but to supplement them. Therefore, the encounter for the course platform introduced a blended learning environment for combined online and offline interactions.

The course platform was introduced as a silo system with no integration with the existing admin platform. The lack of integration between the two systems led to the first situation of an enterprise platform silo in C-Uni. A member of C-Uni's IT unit explained the reason for the emergence of the silo situation as follows.

> *We could not connect the two systems because you know the admin system is old and also proprietary and therefore does not have API interfaces for connection with other systems. We therefore decided that all the data on the admin system needed for working in the course management system will be exported to a CSV file and imported from there to the course platform.*

Episode 1: Course Platform Use

Following the implementation, the course platform has been in use since 2012. Table 2 shows the modules, user groups and uses of the course platform.

Table 2

Course Platform Modules, User Groups and Uses

Modules	User groups	Uses
Course setup	IT staff	• Set up courses for online teaching and learning
Collaboration	Faculty members and students	• Faculty members and students: use collaboration tools for online communication and interaction outside the classroom.
Instruction	Faculty members and students	• Faculty members: use the instruction module to share course syllabus and teaching materials with students. • Students: use instruction services to view and download teaching materials
Assessment	Faculty members and students	• Faculty members: use the assessment module for quizzes and interim assessment. • Students: use this module to respond to quizzes and interim assessment

The IT staff use the setup module to create courses to link manually imported student setup data from the admin platform and faculty members for online interactions. To do this, the IT staff request faculty members to complete an online form with their personal details (employee id, department, school, college, e-mail address) and courses (code and name) they will teach. Some faculty members complained about the approach as a form of duplicating data already captured and stored in the admin platform. They wonder why the two platforms (the admin and the course) cannot share data automatically to avoid the need to request duplicate data from faculty members. A faculty member complained as follows:

> *I don't understand this whole process. The data they are asking us to provide already exists in the [admin platform]. Why can't they automatically pull the data from there? Why waste everybody's time to provide information that already exist? I hate this kind of duplication of effort and resources.*

In the absence of interface modules between the admin and the course platform, the IT staff import data on registered student per course from the admin platform to Excel spreadsheets for reformatting. After that, they import the data from the spreadsheets to the admin platform. This process has been criticized for causing delays and data errors. On this, an IT faculty member commented on the issue as follows:

> *You know, if the course management is an open source, the IT staff should be able to connect it with the admin platform for data sharing*

However, according to the IT staff, they are unable to automate the connection between the platforms due to lack of compatible application programming protocols (API) between the two platforms. Moreover, the admin platform being proprietary does not support available APIs of the course platform.

In all, few faculty members began to use the collaboration, instruction and assessment modules for online interactions with students. The collaboration modules are used by a few faculty members for online interactions with students outside the classroom setting. The few faculty members who use the instruction module share course outlines and teaching materials with students and sometimes use the assessment module for online quizzes and assignments for grading.

However, the few faculty members using the platform have been complaining about lack of online connection to transfer interim assessment and quiz results from the course platform to the admin platform, where final examination results are processed. On this, a faculty member complained as follows:

> *I can use the system to conduct my quizzes and mid-semester exams for the system to grade for me. However, there is no way to transfer the results to the admin system where the end-of-semester exam results is supposed to be entered. Doing this manually for large classes is too frustrating. The IT staff are not being helpful to get this done automatically.*

As a result of these challenges, the course platform received limited adoption from faculty members and students before the Covid-19 in 2020.

Encounter 2: Introduction of Intranet Platform

In 2014, C-Uni contracted DevX (pseudonym), an Indian software company, to develop and implement a web-based intranet platform with workflow, document management, and virtual office modules. The aim of the project was to create a paperless, online environment that would avoid manual processes. DevX developed the platform with open source tools and implemented it with C-Uni's staff. However, as before, the platform was not connected with existing ones (admin and course platforms), thereby creating a three-silo platform environment. On why this was the case, an IT staff and a member of the implementation team noted that:

> *integration with the existing platforms was not part of the initial project. It was expected to be negotiated as an add-on project.*

However, when management of the IT unit and the university itself changed, the project did not continue due to disagreements between the old and the new head of IT. According to the new head, the project was not properly completed and handed over to the C-Uni IT staff to maintain. Conversely, the old head argued that because the platform was developed as an open source system, the IT team should be able to resolve all remaining issues. This conflict has stalled further development of the platform till date. Also, without connection with the other platforms, the intranet platform has its own user login service with a different username and password format.

Episode 2: Use/Non-Use of the Intranet Platform

Following the implementation, the intranet platform went live for use in 2015. Table 3 shows the implemented modules, user groups and uses.

Table 3

Intranet Platform's Implemented Modules, User Groups and Uses

Modules	User groups	Uses
Workflow	Staff and faculty members	• use the workflow module to initiate, approve, and track the status of request, activities and processes
Document management	Staff and faculty members	• use the document management module to create, update, store and retrieve documents related to workflow processes.
Virtual office	Staff, faculty members and management	• Use the virtual office as their dashboard to access and respond to workflow and document management elements.

Due to the controversies surrounding the use of the intranet platform and lack of required support from the IT staff, it has not received complete acceptance and use in the university. The platform therefore has limited use than expected. The few user groups are staff and faculty members in administrative and decision-making units.

As shown in Table 3, a few staff and faculty members use the workflow module to initiate documents for processes involving requests, decisions and approvals as well as track the status of requests and work activities. They also use the document management module to create documents and for updates, storage and retrieval. Finally, some staff and faculty members involved in administrative activities use the virtual office as their dashboards for access to relevant components of the workflow and document management modules.

However, some factors continue to constrain effective use of the intranet platform to achieve the intended purpose of creating a paperless environment. One constraint is that the use of the platform remains voluntary and not mandatory. Also, rules and procedures governing administrative and decision-making activities have not been changed to support migration from offline to online environments. As decision-making committee members, some faculty members complain about lack of access to electronic devices such as laptops and smartphones to enable them to work in a virtual environment, especially the elderly, who are not used to working online.

Due to these challenges, the platform has limited use alongside the manual, paper-based processes, especially as regards inter-office processes. Nevertheless, the situation continues to attract complaints from faculty members who want to see the university operating in a virtual rather than a physical environment. On this, a faculty member complained as follows:

> *In this IT age, I don't know why our university continues to use manual processes. Because of this, we have to chase documents from office to office thereby causing delays in what we do. Sometimes we even get documents missing and one is required to start the process all over.*

Encounter 3: Introduction of Online Teaching Platform during the COVID-19 Pandemic

In March 2020, following the outbreak of the COVID-19 pandemic in Ghana, the government ordered a nationwide lock-down. Subsequently, management of C-Uni closed the university and ordered all students, staff and faculty members to leave campus. The university had seven weeks of teaching and 2 weeks of examination remaining to complete the second semester.

To complete the semester, management decided to migrate teaching and administrative activities online. The IT unit was ordered to activate the online video conference module of the course management system for virtual teaching and meetings. However, when activated, the module was unreliable due to frequent breakdowns during use. Due to lack of integration between the two systems and manual intervention from the IT staff, teaching faculty members could not access the needed information on students while some of the students could not identify courses they had registered on the teaching platform. As was noted by one faculty member:

> *The situation was very frustrating, I am expected to work online with students but most of them were available on the teaching platform for the video and data sharing interactions to take place.*

Another student also shared his frustration:

> *Using the teaching platform for lectures was a huge problem. Some of us could not see our courses on the teaching platform. There was really a problem with moving registration information from the administration platform to the teaching platform.*

Due to the lack of integration between the different platforms, teaching and learning processes were not seamless across the platform silos.

Consequently, the university decided to sign on to a Zoom video conferencing platform, provided by a third-party organization for universities in West Africa. Because the Zoom platform was cloud-based, the deployment was straight forward and did not require much effort from the IT staff. However, as before, the Zoom platform was not connected to the admin platform, which holds the database on students, courses, faculty members and staff. It was also not connected to the course management platform nor the intranet platform. As in the case of the other platforms, the course management platform was implemented with a separate user log in service with different usernames and passwords format.

Episode 3: Use of Online Video Conferencing Platform

From April 2020, C-Uni began to use the Zoom platform for teaching and meetings to meet physical and social distancing requirements. Table 4 shows the key modules implemented, user groups and uses.

Table 4

Zoom Conferencing Platform's Implemented Modules, User Groups and Uses

Modules	User groups	Uses
Meeting	Faculty members, students and staff	• Faculty members: schedule and host meeting with students

Modules	User groups	Uses
		• Students: join and participate in meetings • Administrative staff: schedule meetings for boards and committees • Faculty members and management: join and participate in boards and committee meetings
Recording	Faculty members and staff	• Faculty members: record lecturers to share with students • Staff: admin staff record meetings for evidence and for producing official meetings
Sharing	Faculty members and management	• Faculty members: use the sharing module to project and display documents during lecturing. • Management: chair of a meetings uses sharing to project documents for presentations and discussion
Chat	Students, faculty members and staff	• Students, faculty members and staff use chat for textual interactions during lectures and meetings

The main users of the meeting module are faculty members, administrators, management and students. For teaching, faculty members use the module to set up virtual classroom sessions and send links to students ahead of time. Sending the link was a challenge because there was no connection between the Zoom and the admin platform which hosts the students email and mobile phone contacts.

As a result, the faculty members have to improvise alternative means to get the links to the students, including e-mailing or texting the class representative to forward to the whole class, joining and sending to their WhatsApp or Facebook group or Yahoo and Gmail group account.

Another challenge is that due to lack of connection with student registration on the admin platform, they join the class without their official names. Some join with names of their devices such as iPhone 4 and Lenovo 3. Other use proxy names that have no relationship with the formal names of the students, making it difficult for faculty members to know who is in the class, especially when students start misbehaving.

Another challenge with the silo environment is how to get materials, slides and recorded audio and video output to students. Again, without connection to the students' details on the admin platform, faculty members use alternative means through social media and unofficial e-mail links. Yet these have capacity limitations including file sizes, especially for video files, which need to be broken down before sending.

For administrative meetings including academic and committee meetings, administrators use the meeting module to set up meetings and appointments. Because faculty members and staff had accounts

to the corporate e-mail, sharing links to the meeting was not a problem. However, the identity of attendees became a problem, especially for meetings that involved voting and decision making. Like the teaching situation, some faculty members and staff joined the meetings with their device names. Others had proxy names. Nevertheless, administrators needed to take attendance for the official meeting. So periodically, the convener had to ask people with unofficial names to rename themselves thereby interrupting the meetings.

Given all of these challenges and problems from the previous encounter-episode experiences, participants encounter challenges and frustrations with using the platform silos. Thus, no process could be completed without manually having to contact an IT person to address problems. Also, faculty members, students and administrators could not complete activities seamlessly without manual intervention from IT staff by calling, e-mailing or texting. As was noted with frustration by one faculty member:

> *The migration from offline to online activities in Covid-19 shows the problems with working online with this institution's infrastructure.*

DISCUSSION

This section discusses the research findings in response to the research question on why enterprise platform silos emerge and how they constrain online interactions at the organizational level. It also discusses how organizations can prevent enterprise platform silos and related problems to promote online interactions during Covid-19 and beyond.

Emergence of Enterprise Platform Silos

From the research findings, platform silos can emerge from using legacy installed-base systems without Web APIs, failing to integrate successive platforms into an ecosystem or build internal capability for platform integration, and failing to use enterprise architecture to align digital platforms with organizational processes. From the case results, the initial installed base platform was a legacy proprietary system without web APIs to connect with the subsequently introduced platforms. As a result, the introduction and use of a new platform led to a two-silo platform environment. As the findings show, the admin platform is proprietary, and the system had not been upgraded with advanced Web APIs to connect with other systems. On the other hand, the course platform is an open source system with modern web APIs for integration with other systems. However, because the admin platform installed base does not have web APIs, the two systems could not be integrated to avoid platform silos. The situation shows how a legacy proprietary platform without modern web APIs as an installed base can lead to platform silos. In the IS literature, the use of platforms has been identified as a solution to silo systems. However, the findings show how lack of compatible APIs between platforms result in platform silos.

Another reason for the emergence of the platform silo is failure to integrate successive silos into a platform ecosystem. As shown from the findings, the case organization kept introducing new platforms (platformization) without integrating them into the existing ecosystem. From the case results, the administration platform was the initial installed base with limitations on interconnectivity with other systems. Over the years, it had not been upgraded with web APIs. So, when the workflow and content management platform was being set up, there was no connectivity to link it to the existing enterprise platform, thereby creating the first silo platform environment. This became the practice with subsequent platforms, namely the course management and the video conference platforms for online teaching.

Beyond the legacy and proprietary administration platform without web APIs, the subsequently introduced two platforms, course management and the intranet platform, had web API services and were open source based yet they were not connected. Despite the proprietary nature of the Zoom platform, it does have web APIs and therefore no technical constraints to platform integration. Nonetheless, the web APIs were not used to integrate the Zoom platform with the other two platforms to reduce the existing system complexity. Thus, it is important that new solutions decrease rather than increase the complexity of systems (Bygstad & Hanseth, 2018). For this reason, Constantinides et al. (2018) call for a dual process between platformization and infrastructuring of installed base systems with new ones to avoid the problems with the static platform core, which together constrain innovation.

Another reason for the digital platform silo environment was the lack of an enterprise architecture to connect them into a holistic system aligned with organizational processes. The case results point to a situation where the institution had no enterprise architecture to guide integration of existing and successive digital platforms. Clearly, most of the problems emerged because enterprise architecture analysis had not been conducted on the impact and feasibility of fitting new platforms to the existing infrastructure base. Given the focus of digital platform research on external (marketplace and industry) platforms with platform core and complementary applications interfaced with web APIs (Tormer, 2018), these findings on how internal digital platform silos emerge is novel and hence offer a new insight into how such situations can arise. In the IS literature, enterprise platforms have been identified as the solution to silo systems (Bygstad & Hanseth, 2018; Vestues & Knut, 2019). However, the experience from this case shows that in a multiple enterprise platform environment, silo platforms can emerge. The findings demonstrate the need to move the focus beyond digital platforms to their integration (Tumbas et al., 2017) into ecosystems to enable online interactions, especially for Covid-19 distancing requirements.

Problems with Enterprise Platform Silos

From the case results, the key problems with using enterprise platform silos are lack of access to user information sharing and transfer between platforms, manual intervention for data transfer and related delays, and multiple user sign-in services. First, the case findings show that platform silos constrain data sharing between systems. From the case results, the absence of a system interface between the different platforms made it difficult for one platform to access data stored in another system. For instance, the course management system needed data on courses, students and faculty members from the administration platform, but this could not be automatically provided due to the lack of interface between the two platforms. Similarly, the Zoom video conference platform needed data on students to compile class attendance lists and on faculty members and staff for meeting attendance lists. Again, such a need could not be met due to lack of an interface between the two systems.

Another finding is that platform silos constrain data transfer between systems. In the case of the course management system, faculty members needed to transfer results of interim assessments to the admin platform to combine with the end-of-semester examination. However, the absence of standard interfaces constrained such transfer needs. Within the literature, the problem of data lock-in has been associated with application silos due to their tightly coupled architecture (Demirkan et al., 2008). However, the findings from this study show that notwithstanding the loosely coupled nature of digital platform architecture, data trapping can occur in situations of multiple platforms without web interfaces.

The findings show yet another problem with platform silos as the practice of human intervention for inter-platform data transfer and related delays. This was evident in the case of setups in the course management system, where IT staff need to transfer data from the admin platform to a spreadsheet application middleware for reformatting and error checking before importing the data into the course management

system. A similar situation is the need for faculty members to transfer interim assessment results from the course management system to a spreadsheet application before rekeying them into the admin platform, all through manual processes. Both cases lead to delays and errors, especially with higher volumes of data. Again, given the dominant research focus on external platforms with a single core and multiple complementary applications with standard APIs (Mini & Widjaja, 2019; Tiwana et al., 2010), manual intervention is considered as a new finding for internal platform silos.

Another issue with platform silos is duplication of work on different platforms. From the case results, setting up courses on the administration platform for the semester is duplicated on the course management system due to lack of interfaces between the two systems. In addition, the lack of shared user login services means that the IT staff need to create user profiles for each of the four platform silos, leading to multiple sign-ins and password updates. Thus, for the same enterprise, users need to sign in multiple times in order to access each platform. Meanwhile, the security policy of the institution requires that passwords are changed every 3 months. The situation frustrates users who need to remember four different types of passwords and change them quarterly. What is worse for them is that old passwords cannot be reused. This study's finding on work duplication in platform silo environment is new as extant research on digital platforms focuses on them as solutions to IT silos (Bygstad & Hanseth, 2018), challenging the understanding that platformization solves problems associated with silos. Actually, the problems do not get solved in a multi-platform environment in an organizational context if the various platforms are not integrated into an ecosystem to support information transfer and sharing.

The findings show how the above challenges constrain online interaction that enables members of the organization to work remotely or from home. Yet, as Sein (2020) points out, Covid-19 has forced us to change how we work, learn and live; and that the change will continue even after the pandemic. Hence the need exists for organizations to address constraints of platform silos on online interaction, which has become the norm for current and future work environments.

Preventing Enterprise Platform Silos and Related Problems

Based on the research findings, possible ways to prevent platform silos and their related problems include replacing legacy platforms, infrastructuring installed bases with new platforms into ecosystem platforms, and introducing enterprise architecture. First, since proprietary legacy installed bases can cause platform silos to emerge, they should be replaced with modern platforms with open APIs for interconnectivity with other new systems. From the case results, course management and the Zoom platform have open APIs because of their modern state. However, the admin platform lacks an open API because of its legacy state. Thus, lack of modern, open APIs for the proprietary and legacy admin platform was the key factor for the failure to interface with the new platforms. Open APIs are important to provide standardized interfaces between different platforms; their absence makes it difficult for interconnectivity to occur (Kazan et al., 2018). However, rather than seeking to connect legacy platforms through APIs or software development kits, it is better to replace them to avoid future problems. As noted by Vestues and Knut (2019), platformization should not connect or integrate legacy systems but seek to replace them and their practices.

Another means to prevent digital platform silos is infrastructuring by connecting new platforms with the existing installed base and innovating the platform core, not only the complementary application. Doing so requires that existing platforms and new ones both have open APIs to enable the infrastructuring to occur. In addition, it is important to not only apply standard APIs to support data sharing and transfer but also include API keys that can support single sign-in for users in order to avoid multiple uses and updates of password (Kazan et al., 2018).

While digital platformization has been proposed as a solution to silo systems, its focus is on the application or service levels. However, solving the problems of silos is not just about interconnecting applications; the silos also need breakup (Bygstad & Hanseth, 2018). One way to address this is to develop an ecosystem by infrastructuring platforms through boundary resources to make them loosely coupled instead of hardwired. Doing this needs to be backed by policies that will prevent introducing new platforms without integrating them into the existing platform architecture. The process of doing this has been referred to as infrastructuring platforms to overcome any growing complexity and evolution (Constantinides et al., 2018).

As the findings show, C-Uni over the years has experienced a growing number of digital platforms, beginning with one before 2012 and growing to 4 by 2020. Thus, the organization had not taken the advantage to address problems of technological innovation to connect the various platforms into a platform infrastructure or an ecosystem. The situation also shows lack of ICT policy or standards for introducing new systems. Hence there is the need to adopt the right policy for platform infrastructuring that will ensure that new platforms are configured with existing platforms to avoid problems of silos. Thus, the existing infrastructure needs to move away from independent silos to platform architecture through the process of infrastructuring (Constantinides et al., 2018).

Finally, the need exists for an enterprise architecture to address system complexity and inefficiencies. From the case findings, adding new digital platforms increases the number of silos and hence the complexity of the platform environment. Moreover, lack of connectivity between platform silos leads to duplication and inefficiencies in organizational processes. This problem can be addressed through a well-designed enterprise architecture. As an integrative approach, enterprise architecture thinking enables holistic integration of system portfolios aligned with organizational processes (Bygstad et al., 2015). However, in doing this, care must be taking to avoid a static enterprise architecture that will constrain platform flexibility and innovation. This potential constraint can be avoided by aligning the enterprise architecture with platformization and infrastructuring.

The above measures are considered important for organizations to prevent silo platforms and their related problems to promote seamless online interactions, especially for Covid-19 distancing requirements. As noted by Sein (2020), Covid-19 has forced us into the digital world. Although some organizations have adapted well for online interactions, including working from home (Carroll & Conboy, 2020; Richter, 2020), others still need to do so to ensure business continuity.

CONCLUSION

The purpose of this study was to understand the emergence of enterprise platform silos and their constraints on online interactions. This focus was considered important given the need for organizations to promote online actions and interactions to meet Covid-19 distancing requirements. The findings show that digital platform silos emerge from failure to remove proprietary, legacy installed base platforms without open APIs, failure to infrastructure existing and newly introduced platforms, and not using enterprise architecture to govern platform portfolios. Among the problems with enterprise platform silos are constraints for information sharing and information transfer, manual intervention with delays, and uses of multiple user sign-in services. Possible ways to prevent platform silos and their problems are replacing legacy platforms, infrastructuring existing and new platforms into ecosystems, and introducing flexible enterprise architecture to govern platform portfolios.

Based on the findings, this paper contributes to knowledge on research, theory, and practice as follows. For research, this study extends the dominant focus on external digital platform research to enterprise

digital platforms and silo contexts. By this, the study demonstrates how enterprise platform silos can emerge and the problems associated with their use in an organizational context. This contrasts the dominant focus of existing literature on multi-sided marketplace platforms, which pay less attention to platform silos. The findings also show how platform silos can exist in organizational contexts and the need for IS research to pay more attention to enterprise digital platform silos and their associated problems.

For theory, the study demonstrates a novel use of the encounter-episode process model as a theoretical lens to analyse changes in multiple, parallel, and successive systems across time, leading to situations of platform silos. Prior application of the theory has focused on changes in a single application over time. In contrast, this study shows changes from successive additions of enterprise platforms. From this, other researchers can apply the theory to study increases or decreases in IS portfolios in an organizational context. For practice, the findings present practitioners with measures to prevent the emergence and associated problems with enterprise platform silos by replacing legacy systems through web APIs, infrastructuring existing and new digital platforms, and using flexible enterprise architecture frameworks. The limitation of the study is based on its narrow focus on a single institution in the university sector. Future studies can focus on organizations in other sectors and extend the scope of digital platform silos research to industry and supply chain levels.

REFERENCES

Akaba, T. I., Norta, A., Udokwu, C., & Draheim, D. (2020). A framework for the adoption of blockchain-based e-procurement systems in the public sector. In M. Hattingh, M. Matthee, H. Smuts, I. Pappas, Y.K. Dwivedi, & M. Mäntymäki (Eds), *Responsible Design, Implementation and Use of Information and Communication Technology*. *Proceedings of the 19th IFIP WG 6.11 Conference on e-Business, e-Services and e-Society, Part 1* (pp. 3-14). Springer. https://doi.org/10.1007/978-3-030-44999-5_1

Augustsson, N.-P., Nilsson, A., Holmström, J., & Mathiassen, L. (2019). Managing digital infrastructures: negotiating control and drift in service provisioning. *International Journal of Business Information Systems, 30*(1), 51-78. https://doi.org/10.1504/IJBIS.2019.097045

Baldwin, C., & Woodard, J. (2009). The architecture of platforms: a unified view. In A. Gawer (Ed.), *Platforms, markets and innovation* (pp. 19-44). Edward Elgar Publishing Limited. https://doi.org/10.4337/9781849803311.00008

Bannister, F. (2001). Dismantling the silos: extracting new value from IT investments in public administration. *Information Systems Journal*, *11*(1), 65–84. https://doi.org/10.1046/j.1365-2575.2001.00094.x

Barnes, S. J. (2020). Information management research and practice in the post-Covid-19 world. *International Journal of Information Management, 55*. https://doi.org/10.1016/j.ijinfomgt.2020.102175

Bygstad, B., & Hanseth, O. (2018, June). Transforming digital infrastructures through platformization. *26th European Conference on Information Systems*. Portsmouth, UK. https://aisel.aisnet.org/ecis2018_rp/74

Bygstad, B., Hanseth, O., & Le, D. T. (2015, May). From IT silos to integrated solutions. A study in e-health complexity. *23rd European Conference on Information Systems.* Münster, Germany. https://aisel.aisnet.org/ecis2015_cr/23

Carroll, N., & Conboy, K. (2020). Normalising the "new normal": changing tech-driven work practices under pandemic time pressure. *International Journal of Information Management, 55*. https://doi.org/10.1016/j.ijinfomgt.2020.102186

Conboy, K., & Fitzgerald, G. (2012). Qualitative methods research in information systems: motivations, themes, and contributions. *European Journal of Information Systems*, *21*(1), 113–118. https://doi.org/10.1057/ejis.2011.57

Constantinides, P., Henfridsson, O., & Parker, G. G. (2018). Introduction - platforms and infrastructures in the digital age - semantic scholar. *Information Systems Research*, *29*(2), 381–400. https://doi.org/10.1287/isre.2018.0794

De, R., Pandey, N., & Pal, A. (2020). Impact of digital surge during Covid-19 pandemic: a viewpoint on research and practice. *International Journal of Information Management, 55*. https://doi.org/10.1016/j.ijinfomgt.2020.102171

De Reuver, M., Sørensen, C., & Basole, R. C. (2018). The digital platform: a research agenda. *Journal of Information Technology*, *33*, 124–135. https://doi.org/10.1057/s41265-016-0033-3

Demirkan, H., Kauffman, R. J., Vayghan, J. A., Fill, H. G., Karagiannis, D., & Maglio, P. P. (2008). Service-oriented technology and management: perspectives on research and practice for the coming decade. *Electronic Commerce Research and Applications*, *7*(4), 356-376. https://doi.org/10.1016/j.elerap.2008.07.002

Devadoss, P., & Pan, S. (2007). Enterprise systems use: towards a structurational analysis of enterprise systems induced organizational transformation. *Communications of the Association for Information Systems, 19*, 352-385. https://doi.org/10.17705/1CAIS.01917

Dlodlo, N., & Hamunyela, S. (2017). The status of integration of health information systems in Namibia. *Electronic Journal of Information Systems Evaluation*, *20*(2), 61–75.

Doyle, R., & Conboy, K. (2020). The role of IS in the Covid-19 pandemic: A liquid-modern perspective. *International Journal of Information Management*, 55. https://doi.org/10.1016/j.ijinfomgt.2020.102184

Effah, J. (2020). Virtual platforms for government services in Covid-19 and beyond: a sociomaterial case study of passport service in Ghana. In S. K. Sharma, Y. K. Dwivedi, B. Metri, & N. P. Rana (Eds.), *Re-imagining diffusion and adoption of information technology and systems: a continuing conversation. Proceedings of IFIP WG 8.6 International Conference on Transfer and Diffusion of IT, Part II* (pp. 150–161). Springer International Publishing. https://doi.org/10.1007/978-3-030-64861-9

El Sawy, O., Kræmmergaard, P., Henrik Amsinck, & Vinther, A. (2016). How LEGO built the foundations and enterprise capabilities for digital leadership. *MIS Quarterly Executive*, *15*(2), 141–166.

Fletcher, G., & Griffiths, M. (2020). Digital transformation during a lockdown. *International Journal of Information Management*, *55*. https://doi.org/10.1016/j.ijinfomgt.2020.102185

Gawer, A. (2014). Bridging differing perspectives on technological platforms: toward an integrative framework. *Research Policy*, *43*(7), 1239–1249. https://doi.org/10.1016/j.respol.2014.03.006

Gawer, A., & Cusumano, M. A. (2014). Industry platforms and ecosystem innovation. *Journal of Product Innovation Management*, *31*(3), 417–433. https://doi.org/10.1111/jpim.12105

Gersick, C. (1991). Revolutionary change theories: a multilevel exploration of the punctuated equilibrium paradigm. *Academy of Management Review*, *16*(1), 10–36. https://doi.org/10.5465/amr.1991.4278988

Ghazawneh, A., & Henfridsson, O. (2015). A paradigmatic analysis of digital application marketplaces. *Journal of Information Technology*, *30*(3), 198–208. https://doi.org/10.1057/jit.2015.16

Grover, V. (2019). Surviving and thriving in the evolving digital age: a peek into the future of IS research and practice. *Data Base for Advances in Information Systems*, *50*(1), 25–34. https://doi.org/10.1145/3312576.3312580

Hagiu, A. (2014). Strategic decisions for multisided platforms. *MIT Sloan Management Review*, *55*(2), 71–80.

Hannila, H., Koskinen, J., Harkonen, J., & Haapasalo, H. (2019). Product-level profitability: current challenges and preconditions for data-driven, fact-based product portfolio management. *Journal of Enterprise Information Management*, *33*(1), 214–237. https://doi.org/10.1108/JEIM-05-2019-0127

Hanseth, O., & Bygstad, B. (2018). *Platformization, infrastructuring and platform-oriented infrastructures. A Norwegian e-health case*. *Information Systems Working Papers*. University of Oslo. https://www.mn.uio.no/ifi/english/research/groups/is/working-papers-in-information-systems/wp3-2018.pdf

Holmstrom, H., & Henfridsson, O. (2006). Improving package software through online community knowledge. *Scandinavian Journal of Information Systems*, *18*(1), 3–36.

Kahkonen, T., Smolander, K., & Maglyas, A. (2017). Lack of integration governance in ERP development: a case study on causes and effects. *Enterprise Information Systems*, *11*(8), 1173–1206. https://doi.org/10.1080/17517575.2016.1179347

Kamanga, R., & Matthews, J. N. (2020). The role of digital work platforms in negotiating new power dynamics: experiences from a social digital skills platform in South Africa. *COMPASS '20: Proceedings of the 3rd ACM SIGCAS Conference on Computing and Sustainable Societies* (pp. 329–330). Association for Computing Machinery. https://doi.org/10.1145/3378393.3402251

Kannan, V., Mathew, S., & Lehner, F. (2019, June). Sociomaterial perspective of digital platforms. *27th European Conference on Information Systems*. Stockholm & Uppsala, Sweden. https://aisel.aisnet.org/ecis2019_rip/49

Kazan, E., Tan, C., Lim, E. T. K., Sørensen, C., Damsgaard, J., Kazan, E., … Sørensen, C. (2018). Disentangling digital platform competition: the case of UK mobile payment platforms. *Journal of Management Information Systems*,

35(1), 180–219. https://doi.org/10.1080/07421222.2018.1440772

Klein, H., & Myers, M. (1999). A set of principles for conducting and evaluating interpretive field studies in information systems. *MIS Quarterly*, *23*(1), 67–93.

Kodama, M. (2020). Digitally transforming work styles in an era of infectious disease. *International Journal of Information Management*, *55*. https://doi.org/10.1016/j.ijinfomgt.2020.102172

Lyytinen, K., & Newman, M. (2008). Explaining information systems change: a punctuated socio-technical change model. *European Journal of Information Systems*, *17*(6), 589–613. https://doi.org/10.1057/ejis.2008.50

Mini, T., & Widjaja, T. (2019, December). Tensions in digital platform business models: a literature review. *International Conference on Information Systems*. Munich, Germany. https://aisel.aisnet.org/icis2019/is_heart_of_innovation_ecosystems/innovation_ecosystems/6

Myers, M. (2013). *Qualitative research in business and management*. London: Sage.

Newman, M., & Robey, D. (1992). A social process model of user-analyst relationships. *MIS Quarterly*, *16*(2), 249–266.

Nielsen, P., & Sæbø, J. I. (2016). Three strategies for functional architecting: cases from the health systems of developing countries. *Information Technology for Development*, *22*(1), 134–151. https://doi.org/10.1080/02681102.2015.1026304

Orlikowski, W., & Baroudi, J. J. (1991). Studying information technology in organizations: research approaches and assumptions. *Information Systems Research*, *2*(1), 1–28.

Papadopoulos, T., Baltas, K. N., & Elisavet, M. (2020). The use of digital technologies by small and medium enterprises during COVID-19: implications for theory and practice. *International Journal of Information Management*, *55*. https://doi.org/10.1016/j.ijinfomgt.2020.102192

Parks, R., Wigand, R. T., Othmani, M. B., Serhier, Z., & Bouhaddou, O. (2019). Electronic health records implementation in Morocco: challenges of silo efforts and recommendations for improvements. *International Journal of Medical Informatics*, *129* , 430–437. https://doi.org/10.1016/j.ijmedinf.2019.05.026

Patton, M. Q. (2002). *Qualitative research and evaluation methods*. Thousand Oaks: Sage Publications.

Pollock, N. (2004). ERP systems and the university as a "unique" organization. *Information Technology & People*, *17*(1), 31–52.

Renner-micah, A., Effah, J., & Boateng, R. (2020). Institutional effects on national health insurance digital platform development and use : the case of Ghana. In M. Hattingh, M. Matthee, H. Smuts, I. Pappas, Y. K. Dwivedi, & M. Mäntymäki (Eds.), *Responsible design, implementation and use of information and communication technology: Proceedings of the 19th IFIP WG 6.11 Conference on e-Business, e-Services, and e-Society, , Part 1* (pp. 28–38). Springer. https://doi.org/10.1007/978-3-030-45002-1

Richter, A. (2020). Locked-down digital work. *International Journal of Information Management*, *55*. https://doi.org/10.1016/j.ijinfomgt.2020.102157

Robey, D., & Newman, M. (1996). Sequential patterns in information systems development: an application of a social process model. *ACM Transactions on Information Systems*, *14*(1), 30–63. https://doi.org/10.1145/214174.214178

Rosemann, M., & Watson, E. (2002). Special issue on the AMCIS 2001 workshops: integrating enterprise systems in the university curriculum. *Communications of the Association for Information Systems*, *8*, 200–218.

Saarikko, T. (2015, May). Digital platform development: a service-oriented perspective. *23rd European Conference on Information Systems*, Münster, Germany. https://doi.org/10.18151/7217454

Sein, M. K. (2020). The serendipitous impact of Covid-19 pandemic: a rare opportunity for research and practice. *International Journal of Information Management*, *55*. https://doi.org/10.1016/j.ijinfomgt.2020.102164

Senyo, P. K., Effah, J., & Osabutey, E. L. C. (2021). Digital platformisation as public sector transformation strategy: a case of Ghana's paperless port. *Technological Forecasting and Social Change*, *162*. https://doi.org/10.1016/j.techfore.2020.120387

Silvis, E., & Alexander, P. (2014). A study using a graphical syntax for actor-network theory. *Information Technology & People*, *27*(2), 110–128. https://doi.org/10.1108/ITP-06-2013-0101

Spagnoletti, P., Resca, A., & Lee, G. (2015). A design theory for digital platforms supporting online communities: a multiple case study. *Journal of Information Technology*, *30*(4), 364–380. https://doi.org/10.1057/jit.2014.37

Ter, F., Tan, C., & Tan, B. (2016). Developing a leading digital multi-sided platform: examining IT affordances and competitive in Alibaba.com. *Communications of the Association for Information Systems*, *38*, 738 – 760. https://doi.org/10.17705/1CAIS.03836

Tiwana, A. (2015). Evolutionary competition in platform ecosystems. *Information Systems Research*, *26*(2), 266–281. https://doi.org/10.1287/isre.2015.0573

Tiwana, A., Konsynski, B., & Bush, A. A. (2010). Research commentary—platform evolution: coevolution of platform architecture, governance, and environmental dynamics. *Information Systems Research*, *21*(4), 675–687. https://doi.org/10.1287/isre.1100.0323

Tormer, R. L. (2018, December). Internal digital platforms and generative mechanisms of digital innovation. *39th International Conference on Information Systems*. San Francisco, CA.

Tormer, R. L., & Henningsson, S. (2020, January). Platformization and internationalization in the LEGO Group. *53rd Hawaii International Conference on System Sciences*. Maui, Hawaii. https://doi.org/10.24251/HICSS.2020.709

Tsang-Kosma, W. W. (2010). University staff perspectives on change management strategies in student information system adoption. [Dissertation, Georgia State University]. https://scholarworks.gsu.edu/cgi/viewcontent.cgi?referer=https://scholar.google.com/&httpsredir=1&article=1056&context=msit_diss

Tumbas, S., Berente, N., & Vom Brocke, J. (2017, December). Born digital: growth trajectories of entrepreneurial organizations spanning institutional fields. *38th International Conference on Information Systems*. Seoul, South Korea. http://aisel.aisnet.org/icis2017/TransformingSociety/Presentations/13

Vestues, K., & Knut, R. (2019, August). Making digital infrastructures more generative through platformization and platform- driven software development: an explorative case study. *10th Scandinavian Conference on Information Systems.* Nokia, Finland. https://aisel.aisnet.org/scis2019/4

Wagner, E., & Newell, S. (2004). 'Best' for whom?: the tension between 'best practice' ERP packages and diverse epistemic cultures in a university context. *The Journal of Strategic Information Systems*, *13*(4), 305–328. https://doi.org/10.1016/j.jsis.2004.11.002

Walsham, G. (1995). Interpretive case studies in IS research: nature and method. *European Journal of Information Systems*, 4(2), 74-81. https://doi.org/10.1057/ejis.1995.9

Walsham, G. (2006). Doing interpretive research. *European Journal of Information Systems*, *15*(3), 320–330. https://doi.org/10.1057/palgrave.ejis.3000589

Yoo, Y., Boland, R. J., Lyytinen, K., & Majchrzak, A. (2012). Organizing for innovation in the digitized world. *Organization Science*, *23*(5), 1398–1408. https://doi.org/10.1287/orsc.1120.0771

Yoo, Y., Henfridsson, O., & Lyytinen, K. (2010). Research commentary: The new organizing logic of digital innovation: an agenda for information systems research. *Information Systems Research*, *21*(4), 724–735. https://doi.org/10.1287/isre.ll00.0322

Yoo, Y., Lyytinen, K., Boland, R., Berente, N., Gaskin, J., & Schutz, D. (2010). The next wave of digital innovation: opportunities and challenges: a report on the research workshop 'Digital Challenges in Innovation Research', *SSRN*. http://dx.doi.org/10.2139/ssrn.1622170