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RESEARCH ARTICLE

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Virtualization of government-to-citizen engagement process: Enablers and constraints

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Abstract

The purpose of this study is to investigate the factors that constrain or enable process virtualization in a government-to-citizen engagement process. Past research has established that most e-government projects, especially in developing countries, are regarded as total failure or partial failure. Citizens' unwillingness to use government electronic services and lack of awareness are among some of the reasons why these electronic services fail. Using the process virtualization theory (PVT) as theoretical lens, the authors investigated the various activities within the driver license acquisition process at the Driver and Vehicle Licensing Authority. The PVT helped in identifying factors which enable or inhibit the virtualization of the driver license acquisition process in Ghana. Based on a survey data of 317 participants, we report that process characteristics in the form of relationship requirements affect citizens' willingness toward the use of government virtualized processes. Situating the PVT within a developing country context, our findings reveal that some cultural and behavioral attributes such as socialization hinder the virtualization of some activities within the driver licensing process.

KEYWORDS

driver licensing, e-government, information technology, online services, process virtualization theory

1 | INTRODUCTION

Many governments all over the world are striving for services that are centered on citizens (Velsen, Geest, Hedde, & Derks, 2009). Several motivations abound for governments taking such steps. One of such motivation is to provide a 1-stop shop and online access to information and services to their citizens. To this end, e-government seeks to offer variety of services and information such as public voting information, tax filing, license registration and renewal, and obtaining passports. In the wake of these initiatives, Soufi and Maguire (2007) posited that even though governments are determined to provide services and information to their citizens, the actual services that are provided in the past have failed to meet the expectation of citizens largely because of the lack of user representative and involvement in the design and implementation process (Følstad, Jørgensen, & Krogstie, 2004; Velsen et al., 2009). As a result, most government online services have seen some persistent rejection by citizens (Schwester, 2009).

For over the last decade, information technology (IT) has enhanced the migration of government processes that relied heavily on traditional methods to virtual environments (Balci & Rosenkranz, 2014). In view of this, the shift toward virtualization of government services continues to increase. Virtual processes as used in this paper refer to processes in which physical connections have been removed (Overby, 2008). The term as used in this paper is different from virtualization of machines in the cloud (Zhang, Li, & Zheng, 2013), network virtualization (Berl, Race, Ishmael, & Meer, 2010), and storage virtualization (Shu, Li, & Zheng, 2005). The use of virtual processes has increased because of the advances in IT. As such, most processes that seemed difficult to virtualize are now being virtualized. For instance, traditional or manual voting has been replaced by

electronic voting (e-voting) in some countries (Bishop & Wagner, 2007); government budgeting is also being moved online (Effah & Nuhu, 2017). Such electronic services prove governments' willingness to provide services to their citizenry in an efficient and effective manner. The popularity of government online services is still influencing most governments to move their services from the traditional platforms (face to face) to the virtual platforms. In lieu with the benefits of virtual platforms, it has become inconceivable to envisage life without online processes (Balci, 2014). This notwithstanding, studies have shown that not all processes qualify to be virtualized (Overby, 2008).

Research has shown that both online and offline processes have had some challenges with various government-sponsored initiatives (Bruns & Swift, 2011). This has given room for the rise in the failure of most online citizen-centric initiatives that governments introduce. Alshawi and Alalwany (2009) explained that poor exploitation of e-government initiatives is prevalent in most developing countries. Problems associated with implementation and unwillingness of citizens to use the online system are some of the predominant challenges that confront such initiatives (Chan et al., 2010). Schwester (2009) also attributed resistance and failure of government online services to the perception that technology will replace people in the workplace. That is to say, once people feel threatened they will be replaced, they intend sabotaging the online system.

Despite the role IT plays in virtualized processes, studies have shown that it costs governments a fortune to put their services online. It is estimated that a big portion of IT investment in e-government are wasted because between 60% and 80% of all e-government projects fail (Heeks & Stanforth, 2007). These failed e-government projects are rated as either a total failure (35%), partial failure (50%), or successful (15%) (Heeks, 2003). In line with the previously mentioned forces that contribute to the failure of government-to-citizen services, it has become important to have a more holistic approach to determining which services governments should put online, vis-à-vis which of the services citizens want online.

Driver licensing in Ghana has been characterized with several acts of corruption at almost all levels (Dadzie, 2017). As part of measures by the government of Ghana to curb the menace, there is an ongoing attempt to move away from the physical processes to a virtual process to streamline the driver license acquisition process. It has been well proven that IT plays a critical role in reducing corruption in government engagement processes like driver licensing (Mistry & Jalal 2012). Although the project is necessary to reduce the level of corruption, the susceptibility of the process to be virtualized is also critical, else the project will reach an advance stage only to join the list of failed government projects. It is apparent to understand the factors that inhibit or enable the virtualization of the service to inform software development, hardware acquisition, and even the implementation process.

This study therefore seeks to establish the factors that enable or constrain the ability of the driver licensing process to be moved from the physical environment to a virtual environment with the help of technology. The research questions motivating the study therefore concern which factors enable or constrain the virtualization of processes in government-to-citizen services?

The rest of this paper is organized as follows: Section 2 takes into cognizance related literature and the theoretical background of the study. In Section 3, we outlined some hypotheses for the study based on the research model we discussed. Section 4 entails the methodology we used in undertaking this research. We analyze and present our study results in Section 5, while Section 6 provides the presentation of our findings. The study then concludes with the research implications and limitations.

2 | RELATED WORK AND THEORETICAL BACKGROUND

Government electronic services have several categories, for instance government-to-government and government-to-business among others. The focus of this study is however on government-to-citizen electronic services. Globally, governments are involved in the implementation of a wide range of online applications that will bring their services closer to the citizens (Gichoya, 2005). Despite the attention and investments that are being made, e-government still presents numerous challenges especially within developing country contexts. Universally, there seems to be varying outcomes for most e-government projects. Whereas some developed countries are making major strives, most developing countries are still at the implementation stages of providing electronic services online (Sarrayrih & Sriram, 2015).

This is as a result of the numerous challenges faced during the implementation of such services. Challenges of implementing e-government service can be categorized into technical, organizational, financial, and cultural. Amidst these categorizations, there is enough evidence to show that the main barriers are not technical in nature but rather cultural (Alshehri & Drew, 2010; Feng, 2003). Culture falls under the broader category of social issues that affect the adoption and use of e-government applications by citizens (Alshehri & Drew, 2010). This position supports earlier arguments by Avgerou (2008) which suggests that there should always be a fit between the social and technical subsystems. Some of these social subsytems could be informed by contextual differences. Some researchers have sort to investigate such contextual irregularities (Avgerou, 2008; Verkijika & Wet, 2018; Yildiz, 2012; Zhang, Xu, & Xiao, 2014). For instance, corruption (Aladwani, 2016; Krishnan, Teo, & Lim, 2013) and lack of usability (Venkatesh et al., 2017; Verkijika & Wet, 2018) are among some of the challenges facing e-government projects in developing countries.

Despite several interventions, the situation in developing countries seems to be getting out of hand. As such, scholars are calling for studies to reveal and address the various irregularities in e-government project failure especially in developing countries (Aladwani, 2016). This study responds to part of these calls by understanding from the citizen perspective which service(s) they would prefer online using the PVT as theoretical lens. Driver licensing is 1 of the many services government provide to citizens. It is 1 of the oldest services provided by governments. Migrating such services online has been a challenge to many countries over the years. The current study seeks to investigate the amenability of

the driver licensing activities using the PVT. The PVT basically provides a theoretical basis for the investigation of factors that affect how processes can be virtualized from the users' perspective (Overby, 2008).

As noted in the introductory part of this study, there has been a gradual migration of processes from the traditional platforms to the online platforms, for instance education (Fong et al., 2008; Saltz, Hiltz, Turoff, & Passerini, 2007), online shopping (Ba & Pavlou, 2002; Kim, Galliers, Shin, Ryoo, & Kim, 2012), and online tax filing (Azmi, Kamarulzaman, & Hamid, 2012; Chen, 2010; Hung, Chang, & Kuo, 2013; Schaupp & Carter, 2005; Schaupp, Carter, & McBride, 2010). This notwithstanding, 1 of the oldest government-initiated engagement services with citizens which is driver licensing has not been able to experience full virtualization especially in developing countries. In Ghana, the service is gaining popularity after some of the earlier paper-based activities were virtualized. This became necessary because the paper-based process was characterized by inefficiencies and corruption (Dadzie, 2017). Driver licenses are simply official documents that are given to individual by a state to operate vehicles ranging from motorcycles, cars, trucks, etc. on a public road (NYT, 1913). Several countries today have adopted instituted driver licensing through legal backings. Apart from being a legal requirement to drive on public roads, independence had also necessitated the acquisition of drivers' license (Begg et al., 2009). In Table 1, we present a summary of studies on driver licensing.

The issuance of driver licenses originally started as a means of generating revenue and to be able to hold vehicle drivers responsible for damages on other people and property (Christie, 2000). All over the world today, the shared perspective of various jurisdictions is to maintain safety on all roads, and accidents and damages are avoided on roads (Mayhew, Simpson, & Singhal, 2005).

A search into extant academic literature suggests that a stream of research in this area focuses on graduated driver licensing as shown in Table 1 (Begga, Langley, Brookland, & Ameratunga, 2014; Brooklanda, Begga, Langleya, & Ameratunga, 2014; Mastena, Fossb, & Marshall, 2013; Zhua, Chub, & Li, 2009). The heightened nature of these studies arguably resulted from the increasing number of fatal road accidents involving teenagers and young adults between the ages of 15 and 24 in New Zealand, United States, Canada, and United Kingdom (Begg & Stephenson, 2003).

This notwithstanding, some few studies focus on individual aspects of the license acquisition process. Hirsch, Maag, and Laberge-Nadeau (2006) posited that the licensing process is made up of factors that influence the issuance of licenses. A number of studies also focus on the health and medical issues regarding driver licensing (Racette & Casson, 2005; DeLaey & Colenbrander, 2006). For instance, Bohensky, Charlton, Odell, and Keeffe (2008) studied the implications of eye testing on the licensing of the aged. The results of the study showed that most of the vision tests used as a basis for driver licensing are inconclusive. Overall, some countries have either being able to put some activities of the process online or are in the process of putting them online. Nevertheless, the normative literature is not clear on what forces constrain or enable such moves. More importantly, because the services are meant for the citizens, the authors found it interesting to ask whether these processes were tested from the perspective of the citizens before virtualization?

From the review, academic research that covers all the activities in acquiring a new driver license is arguably nonexistent. We however identified a study on how citizens can use online systems to renew their drivers' license and make payments online (Layne & Lee, 2001). This gives credence that some of the activities have been migrated online, but the results seem to be inclusive because the studies did not show all the activities in the license acquisition process and show which have been migrated online. Furthermore, past studies did not provide reasons why the process involved in acquiring a drivers' license is performed physically or electronically. A typical example is the eye test, which require some face-to-face interactions with the prospective license owner (Begg, Langley, Brookland, & Ameratunga, 2014). Reasons for this however have not been provided in the academic literature. Following the recommendations of Snead and Wright (2014), this current study seeks to identify the license acquisition process and their subactivities to be able to establish their level of amenability to the online platform by using the PVT.

Across the various jurisdictions, acquiring a driver license follows similar procedures such as registration, theoretical exams, and practical exams. In Ghana, acquiring a new driver license follows the following steps: (1) registration, (2) performing an eye test, (3) written test, (4) driving sign test, and (5) practical driving test (www.dvla.gov.gh). In the United Kingdom however, the process involves the folowing: (1) apply for a

TABLE 1 Research focusing on driver licensing

Research Study	Research Focus	Underpinning Theory and/or Framework	Research Method and Country	Relevant Gaps for Future Research
Williams, Tefft, and Grabowski (2012)	The study performed a review of literature between 2010 and 2012 on graduated driver licensing	No defined framework or theory	Qualitative USA	Future research can explore the licensing trends of the youth and its effects on Graduated Driver Licensing
Begg et al. (2014)	The study showed that generally, prelicensed driving knowledge had considerably little effect on crash involvement at the learner or restricted license stage	No defined framework or theory	Mixed methods New Zealand	Need for more in-depth exploratory research on prelicensing.
Bohensky et al. (2008)	The study shows that the projecting values of vision test used in issuing driver license in selected countries are generally not conclusive	No defined framework or theory	Qualitative Australia	Need for further research to assess the adequacy of existing visual assessment programs for effective road safety outcomes.
Hirsch et al. (2006)	The study explored the role that driver education has on the licensing process	Licensing process framework	Quantitative Canada	More research on the development of drivers' permit evaluation that could predict future safe driving

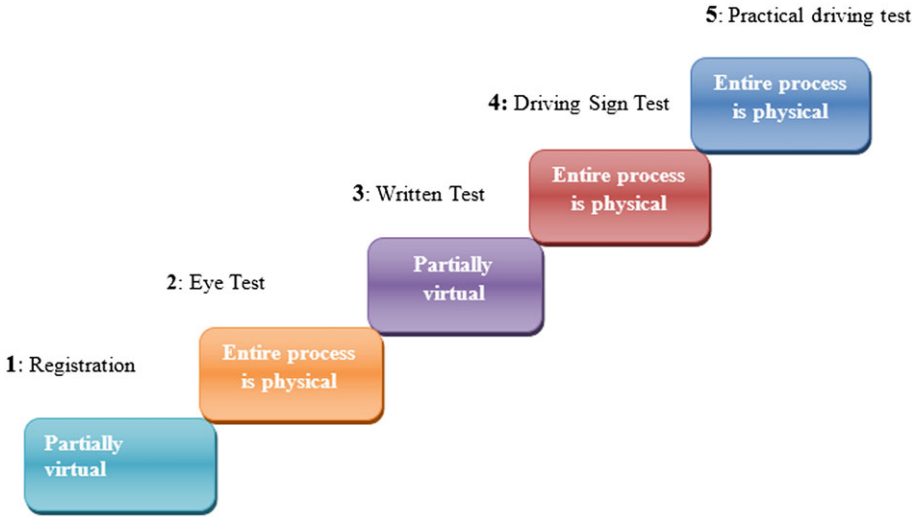

FIGURE 1 New driver licensing acquisition process in Ghana

provisional license, (2) writing a theory test, (3) practical training, (4) practical driving test, and (5) practical demonstration test (www.gov.uk). These processes largely follow international best practices of issuing new driver licenses. In Figure 1, the authors provide a breakdown of the various activities involved in acquiring a drivers' license in Ghana. The figure also establishes the current state of each activity in the process. In a quantitative study like this, the focus was on the registration and written test activities. The choice for these 2 is because they are fraught with several inefficiencies and corruption. These 2 activities are perceived very fundamental to the organization. Besides they are those activities that are being migrated at the time of this study. As shown in the figure, the driver licensing process consists of subactivities including registration, eye test, written test, driving sign test, and practical driving test. By standard, a citizen needs to excel in each activity before they are issued with a license. As shown in Figure 1, the registration activity is partially virtual. This is because the activity starts online and ends manually.

3 | RESEARCH MODEL

This study draws on the process virtualization theory (PVT) (Overby, 2008) as analytical lens to understand the factors that constrain or enable the virtualization of a government-to-citizen electronic service. Being an emergent theory, empirical testing of the PVT is still nascent (Balci & Rosenkranz, 2014). The PVT though new seems to have bright prospects relative to how processes are virtualized. Since it was propounded in 2008 by Eric Overby, the PVT has gained a lot of attention among information systems researchers because it is 1 of the "home-grown theories." There have been several calls for its applicability in several other contexts. These calls have recently been answered by researchers such as Maedche and Graupner (2015), who adopted the PVT to investigate the retail banking sector. Findings from this study showed that there are some limitations to the virtualized process because of high sensory requirement and identification and control requirements. Other recent studies have also adapted the PVT and used it in other contexts (Connolly & Judge, 2016; Ofoeda & Boateng, 2016). Barth and Veit (2011) as part of measures to improve the theory expanded the theory into a multicausal model which was subsequently used in both qualitative and quantitative studies. The applicability of the PVT in a government engagement process like this we believe is a step in the right direction.

Having identified a major research issue in e-government (in the introductory section), the PVT is very applicable to the issues identified. The PVT is based on a premise that some physical processes are better suited for online platforms than others (Overby, 2008). It therefore provides a theoretical starting point to exploring the factors that could affect how virtualizable a process is from the perspective of a user (Balci & Rosenkranz, 2014). The justification for choosing the PVT is based on its rich and useful concepts it offers to understand processes that can or cannot be virtualized. It also offers much insight into process more than adoption theories like TAM, etc.

Overby (2008) defines a process as a set of steps to achieve a goal or an objective. Processes can be made up of several activities that can be undertaken solely or simultaneously. Two kinds of processes exist: the physical and virtual processes; there is also a type called hybrid processes. Physical processes involve human interaction between people and objects (Overby, 2008), whereas in virtual processes, the physical interactions between people and objects are removed (Overby, 2008). In virtualizing a process, the responsibility of the human actor as we see in the physical process is shifted to an information system (Overby, Slaughter, & Konsynski, 2010). Pursuant to this, Overby (2012) underscored that the transition of a process from the physical to the virtual environment is termed as "process virtualization." Overby also explains the role IT plays in the transition process, and thus considers IT as an enabler of most virtual processes even though not all processes are virtualized using IT (Overby, 2008). This presupposes that virtualization of a process can either be IT based or non-IT based (Overby, 2008). An example of a non-IT-based virtual process is the mail-order catalogs which allow people to take part in virtual shopping processes without the use of IT (Overby & Konsynski, 2010).

The theory presents us with 4 main independent constructs. They are sensory requirements, relationship requirements, synchronism requirements, and identification and control requirements. Overby (2008) refers to these constructs as the characteristics of the process. They are also perceived to have a negative effect on process virtualization (Overby, 2012; Overby & Konsynski, 2010). What this means is that as these constructs increase, it is unlikely for such process to be virtualized. Recognizing the importance of technology in virtualizing processes, the theory makes clear the contribution of IT by making use of the moderating effects which include representation, reach, and monitoring capabilities (Overby, 2008). These 3 moderating factors are considered to have a positive influence or impact on process virtualizability (Balci & Rosenkranz, 2014; Overby, 2012). Each of the 3 constructs moderate the relationships between the characteristics of the process and its virtualizability (Balci & Rosenkranz, 2014; Overby, 2012).

The dependent variable in process virtualization is termed as process virtualizability. Overby (2008) conceived that process virtualizability is a continuous variable (further discussed by Overby, 2012) that illustrates how amenable a process is to being conducted without any form of physical interaction between people or amid people and objects. Process virtualizability is deemed to be measured effectively in 2 ways: namely, acceptance of the virtual process or the results of the virtual process (Overby, 2008). Figure 2 presents the research model as adapted from (Overby, 2012).

Sensory requirements (SR) are defined as "the need for process participants to be able to enjoy a full sensory experience of the process and the other process participants and objects. Sensory experience includes seeing, hearing, smelling, touching, and tasting" (Overby, 2008, p. 280), and they impact the use of virtual processes negatively. The reasoning here is that the lesser the SR of a process, the more suitable the process is to be conducted virtually and vice versa. Most often, the sensory experiences such as sight and touch form barriers to virtualized processes especially shopping processes that involve the purchase of food and other related items (Ramus & Nielsen, 2005). Past research has corroborated the relationship, thus either positive (Barth & Veit, 2011) or positive (Balci, 2014, 2014b). Based on this, the following hypotheses were tested on the registration process and the written test process.

H1a The higher (lower) the sensory requirements (SR) of the registration process, the less (more) suitable it is to being conducted virtually.

H1b The higher (lower) the sensory requirements (SR) of the written test process, the less (more) suitable it is to being conducted virtually.

Relationship requirements (RR) are defined as "the need for process participants to interact with one another in a social or professional context" (Overby, 2008, p. 281). Overby (2008) contended that people acquire knowledge and develop trust and friendship through social interactions. All things being equal, a process with a higher relationship will be resistant to virtualization (Overby & Konsynski, 2008). In view of this, the more preference participants place on RR, the less amenable the process will be to virtualization. Though there is a general belief that relationships in physical environments are stronger and more developed, it does not also preclude high RR processes to be virtualized (Mesch & Talmud, 2006). Prior studies have shown that RR negatively impact users' intention to use digital processes (Balci, 2014). This is because user does not place much importance on socialization and its related activities (Balci, 2014b). Koppius, Van Heck, and Wolters (2004) also argued that a deficiency in relation could affect use of online markets.

This lead to the following hypotheses:

H2a The higher (lower) the relationship requirements (RR) of the registration process, the less (more) suitable it is to being conducted virtually.

H2b The higher (lower) the relationship requirements (RR) of the written test process, the less (more) suitable it is to being conducted virtually.

Synchronism requirements (sync. req.) is explained as "the degree to which the activities in a process need to occur quickly with minimal delay" (Overby, 2008, p. 281). This means that when the synchronism requirements of a process are high, then the process is unlikely to be virtualized. However, when the synchronism requirements of the process are less, there is a propensity that such process can easily be virtualized.

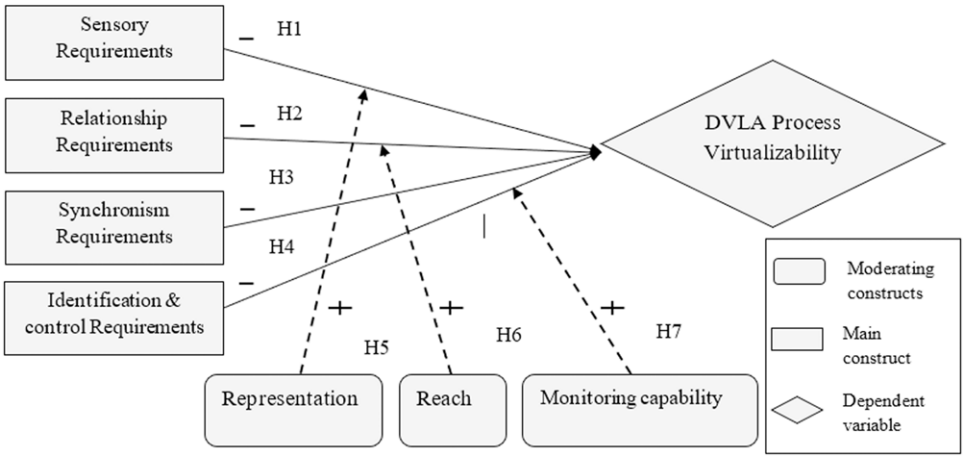

FIGURE 2 Theoretical model (modified from Overby (2012))

Past research has identified a negative and significant relationship between synchronism requirements and process virtualization (Balci, Grgecic, & Rosenkranz, 2013; Barth & Veit, 2011). Findings indicate that online process users do not place much importance on the process characteristics of synchronism requirement, thus ensuring that they are amenable to virtualization. In view of this, we derive the following hypotheses:

H3a The higher (lower) the synchronism requirements (SR) of the registration process, the less (more) suitable it is to being conducted virtually.

H3b The higher (lower) the synchronism requirements (SR) of the written test process, the less (more) suitable it is to being conducted virtually.

Identification and control requirements (ID and CR) is the "the degree to which the process requires unique identification of process participants and the ability to exert control or influence over their behavior. Identification and control requirements are seen to have a negative relation to process virtualizability." The reasoning here is that processes with greater (lower) identification and control requirements are less (more) amenable to virtualization (Overby, 2008, p. 282). Some studies investigated ID&CR as 1 construct as propounded originally (Balci et al., 2013; Barth & Veit, 2011). However, other authors such as Graupner and Maedche (2015) consider ID&CR as 2 separate constructs. The current study however combines the 2 as advocated originally by Overby (2008). In line with this, we have the following hypotheses:

H4a The higher (lower) the identification and control requirements (IDC) of the registration process, the less (more) suitable it is to being conducted virtually.

H4 The higher (lower) the Identification and control requirements (IDC) of the written test process, the less (more) suitable it is to being conducted virtually.

3.1 | Moderating construct

The moderating constructs are what Overby (2008, 2012) refer to as the characteristics of the virtualization mechanism. Numbering 3 in all, the moderating constructs of reach, representation, and monitoring capability influence the relationship between the main constructs and process virtualizability positively. As explained earlier, though IT plays an integral role in virtualized processes, not all processes are virtualized with IT (Overby & Konsynski, 2008). For instance, friendship development could be based on a face-to-face interaction which is physical in nature. On the other hand, letter writing between friends is a virtual but non-IT based. IT plays significant roles in virtualized processes in using forms of haptic technologies that permit forms of touch-enabled interaction with virtual objects by providing 3-dimensional view of products. The moderating constructs which are IT enabled influence the independent constructs which are physical and negative in nature. According to Overby (2012), the moderating could also have a direct positive influence on process virtualizability as well. Whereas some past studies sort to neglect the role of the moderating constructs (Balci, 2014b; Graupner & Maedche, 2015), the current study includes all moderating constructs of the PVT because they are deemed applicable. Their direct impact on process virtualizability is however not included in the current study. The authors only seek to know how the moderating constructs influence the direct relationship between the dependent and independent variables.

Representation emphases on the ability of IT to "present information relevant to a process including simulations of actors and objects within the physical world, their properties and characteristics, and how individuals interact with them" (Overby & Konsynski, 2008. p. 52). This construct helps to incorporate SR into virtual processes that are IT-based (Suh & Lee, 2005; Overby, 2008). Processes with good representation capabilities of IT also have a positive main effect on process virtualizability (Balci & Rosenkranz, 2014). *Representation* also moderates the relationships between SR and RR (Overby, 2012). For the purposes of this study however, the focus is on how relationship moderates the SR of participants in the driver licensing acquisition process. Overby (2008) advice that not all constructs could be measured; thus, the choice of a construct could also be influenced by context. Based on this assertion, we derive the following hypotheses:

H5a There is a positive moderation effect of representation on the relationship between sensory requirements and the virtualizability process of registration.

H5b There is a positive moderation effect of representation on the relationship between sensory requirements and the virtualizability process of the written test.

Reach is the capability of IT that permits process participation to take part in a process devoid of time and space. This offers various actors the flexibility to partake in a process anywhere in the world at any time. To this end, IT can allow several processes to be conducted throughout the day irrespective of boundaries such as geographical boundaries (Overby & Konsynski, 2008). Originally, *reach* moderates sensory and synchronism requirements as well as process virtualizability (Overby, 2012). For the purposes of this study however, the moderation is based on RR only. From these explanations, we derive the following hypotheses:

H6a There is a positive moderation effect of reach on the relationship between relationship requirements and the virtualizability process of registration.

H6b There is a positive moderation effect of reach on the relationship between relationship requirements and the virtualizability process of written test.

Monitoring capability offers an IT-based that helps to identity and authenticate participants in a process. It also allows for the tracking of process participants. Various authentication mechanisms exist for this purpose. Some of these include IDs, password, biometric tokens, etc. (Overby & Konsynski, 2008; Hahn & Hinton, 2012). Monitoring capability controls the relationship between identification and control requirements and process virtualizability (Overby & Konsynski, 2008). In this study however, it is measured against only identification and control requirements. From this, the following hypotheses were derived:

H7a There is a positive moderation effect of monitoring and capability between identity & control requirements and the virtualizability process of registration.

H7b There is a positive moderation effect of monitoring and capability between identity & control requirements and the virtualizability process of the written test.

In the context of this study, the process involved in acquiring a new drivers' license is made of subactivities. While some of these activities have been virtualized to enhance service delivery, other activities are still being conducted physically (ie, require physical interaction with entities involved in the process). In this light, explaining the reasons for the disparity in physical and virtual processes is necessary. This we seek to do by using the PVT as a theoretical lens (Overby, 2008). Besides being overdependent on case study research, the e-government literature also seems to be undertheorized (Bannister & Connolly, 2015).

Hitherto, the use of the PVT to investigate the engagement process that exist between government and its citizens is arguable nonexistent even though some research points to the use of the PVT in the e-government domain particularly procurement (Boughzala, Assar, & Romano, 2010) and e-commerce perspective (Barth & Veit, 2011). The choice of the PVT was deliberate, because the several information systems theories (TAM, TTF, TOE, DOI, etc.) could not satisfy the objectives of the current study except for the PVT. In the richness, the PVT is richer. Barth and Veit (2011) point out 2 reasons to this effect. First, the PVT targets all kinds of processes, whereas others target tasks associated with communication only. Second, the PVT uses a more extensive range of process characteristics. The PVT therefore provides the finest initial point for investigating the engagement process between citizens and government. To understand how processes are migrated to the virtual environment, it is important to know if from a user perspective such processes are amenable to virtualization. Lastly, the choice of using the PVT to investigate the engagement processes of government and citizen activities is an answer to calls for its application in other jurisdictions and applications domains (Balci et al., 2013; Overby, 2012).

3.2 | Situating the process virtualization theory within the DVLA

This study does not only seek to test the PVT within an African context but move beyond testing to situating the theory within an African country organization (Driver and Vehicle Licensing Authority (DVLA)). This has become important because of contextual differences which the authors believe is very important in information systems research. In situating the PVT within the DVLA, it came to light that several activities were needed within the license acquisition process. It is against this backdrop that each of the activities was modeled against the constructs of the PVT. As such, the authors were able to identify the factors that influenced the various activities in the license acquisition process as against their level of amenability, not forgetting the role(s) IT play in such phenomenon (Balci & Rosenkranz, 2014; Overby, 2008).

4 | RESEARCH METHODOLOGY

4.1 | Data collection

Empirical testing of the PVT is still nascent (Balci et al., 2013; Overby, 2012). As such, a specific process was studied (acquisition of a new driver license) which has other subactivities. We therefore focus on 2 activities of the entire process (registration and the written test activities). At the time of this study, the subactivities were either physical or virtual in nature. Data were collected from a cross section of driver license holders in Ghana. Selection of the new driver license acquisition process was informed by some reasons: First, acquiring a license is compulsory. This is because one will have to possess a valid drivers' license before driving on public roads in Ghana. Second, the process involved both physical and virtual methods which make it interesting for investigation. Third, the manual process has been in existence for several years before the DVLA decided to automate some of the processes.

Before the main data collection begun, a pilot test was conducted on 20 individuals who own valid driver's license. The pilot study enabled the authors to gather some preliminary insights on the comprehensibility and lucidity of the questionnaire items. The pilot study also aided the authors to refine the various items in the questionnaire. A total of 480 questionnaires were distributed during the main study, with 382 questionnaires being received after distribution. After analyzing the 382 questionnaires, 65 were deemed defective because they were either returned unanswered, or partially answered. In all, the researchers had a total of 317 valid questionnaires to work with. This remaining figure formed the basis for the quantitative analysis. The demographic distribution of the respondents is shown in Table 2.

TABLE 2 Profile of respondents

Profile	Measurement	Percentage
Gender	Male	65.6%
	Female	34.4
	Total	100%
Education	High school	11%
	Bachelor's degree	37.5
	Master's degree	43.8
	PhD (Doctorate)	4.8
	Professional	2.9
	Total	100%

4.2 | Measurement

Based on the review of extant literature and the theoretical model (PVT), we adapted most of the measurement items from previous research. The modification was to ensure that the measurement items were consistent with the context of study and ensure validity (Balci, 2014b; Moore & Benbasat, 1991). Overby (2008, p. 279) suggested that we can measure process virtualizability either as adoption of a virtual process or the quality of the outcome of a virtual process. The current study has become necessary because of the increasing failure of government e-services. It has therefore become expedient to understand which of the driver licensing activities could actually qualify for virtualization and make recommendation to government and stakeholders. All the items generated for the study were rated on a 5-point Likert scale (Likert, 1932) with the anchors strongly disagree (1) to strongly agree (5). Relative to the reliability test, only items that met the 0.6 threshold as suggested by Hair (2010) were considered. Similarly, the Cronbach alpha of our loaded survey items had a 7.0 threshold (Hair, 2010; Pallant, 2011). Table 3 details our measurement scales including some fundamental references.

TABLE 3 Measurement scales

Construct	Item		Loading	Source
Sensory requirements (SR)	Sens1	I prefer to pick up my registration documents from the DVLA office	.679	Overby and Konsynski (2010), Barth and Veit (2011), 2014
	Sens2	I prefer to fill my form with pen and paper	.698	
	Sens3	I feel more comfortable when I hold and submit my registration forms	.692	
	Sens4	I prefer getting immediate feedback on my registration status	.840	
	Sens5	I need to touch and verify registration documents before filling them out	.727	
	Sens6	While I am doing my registration, I like to be able to see and touch the registration documents	.753	
Relationship requirements (RR)	Rel2	I enjoy having personal contact and informal interaction with the responsible employees	.614	Overby and Konsynski (2010), Barth and Veit (2011), 2014
	Rel3	I would like to call for assistance and advice from the responsible personnel	.888	
	Rel4	I enjoy my physical presence at the offices so that I can ask the names and contacts of the responsible personnel	.833	
Synchronism requirements	Syn1	I like to submit my form immediately I complete it	.819	Overby and Konsynski (2010), Barth and Veit (2011), 2014
	Syn2	I think that my registration will be faster using an online method	.780	
	Syn3	I like to pay my fees at the same time	.693	
Identification and control requirements	IDR1	I like to take note of other people who come to register	.715	Overby and Konsynski (2010), 2014
	IDR2	I like the staff of DVLA to recognize me	.904	
	IDR3	I would like to know who receives my forms	.846	
	IDR5	I don't have control over my personal information and data while registering online.	.717	
Representation	Rep1	I can get information about the registration online	.790	Overby and Konsynski (2010)
	Rep2	I can use the Internet to register for my license	.870	
	Rep4	The Internet notifies me if I complete my registration process	.880	
Reach	Reach1	I can register for my license at anytime	.893	Overby and Konsynski (2010)
	Reach2	I can register for my license at any place	.678	
	Reach3	I can request for other services that I want	.692	
Monitoring capability	Mon1	I have to provide my bio data online	.740	Barth and Veit (2011), Balci and Rosenkranz (2014)
	Mon2	My national ID card has to be confirmed	.730	
	Mon3	I have to enter a valid email address	.900	
	Mon4	The Internet is able to track my progress when registering	.803	
Virtualizability of registration process	PV1	Overall, online registration process supports my needs to manage my license acquisition process	.628	Balci et al. (2013)
	PV2	The online exams have completely replaced traditional method	.720	
	PV3	Overall, the online exams give me control over what I do.	.769	
	PV4	I will rate the online process of acquiring a new drivers' license as satisfactory	.673	

The study used a questionnaire-based survey design to test our research model. A preliminary data cleansing and screening was carried out to exempt unanswered and incomplete questionnaires. The responses were subsequently coded into SPSS (version 20) for analysis. Ascertaining the mean of all our variables ensured that we run for *t*-test and standard deviation was run. A Kaiser-Meyer-Olkin (KMO) sampling measurement was also adopted to determine the appropriateness of factor analysis for the study. To determine the adequacy of the sampling, we performed a reliability test for the survey items based on their Cronbach's alpha. Finally, we tested for how the various independent variables fared on the dependent variable. To do this, we performed a sequential multiple regression (hierarchical regression). In performing the regression analysis, the independent variables were multiplied by (*) the interaction term and to show whether the interactions are modeled best using the multiple regression (Goodhue, Lewis, & Thompson, 2007; Ofoeda & Boateng, 2016). Based on our theoretical basis, each independent variable was entered in steps or blocks (Pallant, 2007). Based on this, we were able to assess each independent variable and what each added to the predictor variable.

5 | DATA ANALYSIS AND RESULTS

Our analysis follows a sequential regression to test the various hypotheses. First is to determine the independent variables (predictors) that support the PVT. The second phase was to determine under which conditions the moderators influenced the relationship between both dependent and independent variables (Baron & Kenny, 1986; Kim, Kaye, & Wright, 2001). In this section, we present results of our findings vis-à-vis the analysis. First, we present results for the registration and then analysis for the written test activity followed.

5.1 | Results for the registration activity

In support of hypothesis 1a, which predicted that the lower (higher) the SR of the registration process, the more (less) suitable it is to be conducted virtually. As shown in Table 4, sensory requirement had a significant negative impact on the virtualizability of the registration process (β = −.14**; P < .01). The interaction term had a beta coefficient of .051 and did explain a variance in process virtualizability (ΔR^2 = .002). Subsequently, there is evidence to prove that representation had a positive correlation on the virtualizability of the registration process. The coefficient for representation is however insignificant. This suggests that a positive relationship exists, but it adds no explanatory beyond that of the other independent variables; hence, there is no support for hypothesis 5a which is a corresponding moderator hypothesis to hypothesis 1a.

As illustrated in Table 5, the beta coefficients of RR and reach were −.080 and −.041 respectively. This means that there was an inverse relation between RR and process virtualizability. Lastly, the coefficient of the interaction term was .086. There is therefore evidence to support that RR is negatively correlated to the virtualization of the registration process. However, the corresponding coefficient for RR is insignificant. This suggests that a negative relationship exists, but it adds no explanatory beyond that of the other independent variables; hence, there is no support for hypothesis 2a. In a similar vein, the moderating term of Reach was negative and insignificant; hence, it does not support hypothesis 6a.

TABLE 4 Multiple regression analysis for SR and PV in the registration process

Variable	*B*	R^2	ΔR^2	*F*	Δ *F*
Step 1 Sensory requirement	−.141**	.020	.020**	6.54**	6.54*
Step 2 Sensory requirement (A) Representation (B)	−.141** .000	.020	. 000	3.26*	.000
Step 3 Sensory requirement (A) Representation (B) Interaction (A) × (B)	−.141** .000 .051	.023	.002	2.43	.776

N = 317. *P < .05, **P < .01, ***P < .001.

TABLE 5 Multiple regression analysis for RR and PV in the registration process

Variable	*B*	R^2	ΔR^2	*F*	Δ *F*
Step 1 Relationship requirement	−.080	.007	.007	2.43	2.36
Step 2 Relationship requirement (A) Reach (B)	−.080 −.041	.008	. 001	1.32	.29
Step 3 Relationship requirement (A) Reach (B) Interaction (A) × (B)	−.080 .041 .086	.011 .011	.003	1.18	.89

N = 317. *P < .05, **P < .01, ***P < .001.

TABLE 6 Multiple regression for syn req and PV in the registration process

Variable	*B*	R^2	ΔR^2	*F*	Δ *F*
Step 1 Synchronism requirement	−.093*	.011	.011***	3.37	3.37

N = 317. *$P < .05$, **$P < .01$, ***$P < .001$.

TABLE 7 Multiple regression analysis for ID and control requirement and PV

Variable	*B*	R^2	ΔR^2	*F*	Δ *F*
Step 1 ID and control requirement	−.002	.000	.000	.001	.001
Step 2 ID and control requirement (A) Monitoring and capability (B)	−.003 .083	.003	.003	.53	1.07
Step 3 ID and control requirement (A) Monitoring and capability (B) Interaction (A) × (B)	−.003 .083 .030	.004 .004	.000	.39	.091

N = 317. *$P < .05$, **$P < .01$, ***$P < .001$.

According to Overby (2008), not all the constructs in the PVT can be applicable; hence, exemptions were made on the moderation construct of the synchronism requirement (Table 6). When the predictor variable which is synchronism requirement, was entered into the model, the beta coefficient was −.093 at a significance level of $P < .05$ further giving support to hypothesis 3a which predicts that the higher (lower) the synchronism requirements of the registration process, the less (more) suitable it is to be conducted virtually.

As illustrated in Table 7, the beta coefficients of ID and control requirement and monitoring and capability were −.003 and .083 respectively. These coefficient values do not however contribute significantly to the model; hence, hypothesis 4a is not supported. Lastly, the interaction term had a coefficient value of .30. Monitoring and capability is positively correlated to process virtualizability (.083). This suggests that a positive relationship exits, but that it adds no explanatory power beyond that of the other variables; hence, hypothesis 7a is not supported.

5.2 | Analysis of examination activity

Having established the results of the registration activity for acquiring a new drivers' license, we further performed another 3-step regression on the examination activity. The results are discussed in the succeeding text (Table 8).

TABLE 8 Multiple regression analysis for SR and PV in the written exams

Variable	*B*	R^2	ΔR^2	*F*	Δ *F*
Step 1 Sensory requirement	−.178*	.021	.012*	3.971*	3.971*
Step 2 Sensory requirement (A) Representation (B)	−.167 .193*	.025	.013	.034*	4.059*
Step 3 Sensory requirement (A) Representation (B) Interaction (A) × (B)	−.167 .193* .453	0.36 .036	0.11	.860**	3.450

N = 317. *$P < .05$, **$P < .01$, ***$P < .001$.

TABLE 9 Multiple regression analysis for RR and PV of the exam process

Variable	*B*	R^2	ΔR^2	*F*	Δ *F*
Step 1 Relationship requirement	−.191*	.017	.017*	5.448*	5.448*
Step 2 Relationship requirement (A) Reach (B)	−.204* −.114	.021	.0043	.406	1.358
Step 3 Relationship requirement (A) Reach (B) Interaction (A) × (B)	.204* .114 .340	.031 .031	.0103	.358*	3.215

N = 317. *$P < .05$, **$P < .01$, ***$P < .001$.

TABLE 10 Multiple regression analysis for syn. req. and PV of exam process

Variable	β	R^2	ΔR^2	F	ΔF
Step 1 Synchronism requirement	.469***	.098	.098***	34.155***	34.155***

N = 317. *P < .05, **P < .01, ***P < .001.

TABLE 11 Multiple regression analysis for ID and control req. and PV of the exam process

Variable	β	R^2	ΔR^2	F	ΔF
Step 1 ID and control requirement	−.211**	.018	.018*	5.857**	5.857*
Step 2 ID and control requirement (A) Monitoring and capability (B)	−.158 .444**	.049	.031**	8.079***	10.130**
Step 3 ID and control requirement (A) Monitoring and capability (B) Interaction (A) × (B)	−.158 .444** .360	.054 .054	.005	5.915***	1.560

N = 317. *P < .05, **P < .01, ***P < .001.

Per the outcome of the regression analysis, we found support for hypothesis 1b; SR have a significant negative impact on citizens using the online exams (β = −.167; P < .05). Representation also contributed significantly to process virtualizability (β = .193, ΔR^2 = .02, P < .05) further giving support to hypothesis 5b. Lastly, the interaction term had a coefficient value of.453, though the overall model is significant at P < .0.

From the analysis, RR with its beta value of −.204 was also found to be significant at P < .05, giving support to hypothesis 2b. Considering hypothesis 6b, reach is supposed to have a positive impact on process virtualizability, but in this case, it is negative and was found to have an insignificant impact on the virtualizability of the written test. In view of this, hypothesis 6b was not supported. Lastly, the interaction term had a beta coefficient of .340, but it did not explain a significant variance in process virtualizability (ΔR^2 .0103) (Tables 9–11).

When the predictor variable (synchronism requirement) was entered the model, the beta coefficient was.47 at a significant level of P < .001. This value does not give support to hypothesis 3_b which predicted a negative impact on process virtualizability.

It is evident that hypothesis 4b had a significant negative impact on citizens use of the online system to write the exams (−.158; P < .01), giving support to hypothesis 4b. Hypothesis 7b was however not supported because it did not have any positive impact on citizens use of the internet to write the exams (−.444; P < .01).

6 | DISCUSSION

The current study established the applicability of the PVT in an e-government service within a developing country context. In its entirety, the study found that the assessment of the process characteristics indeed directs to either a higher or lower process virtualizability. Some of these process characteristics are also moderated by some virtualization mechanisms. Using the PVT as the theoretical lens, we assessed why some of the activities of acquiring a new drivers' license were not virtualized from the perspective of the user. This research further explains that certain behavioral threats of users can hinder the virtualization of government services. As performed for the analysis, the discussion is also based on the 2 activities investigated: registration and written test.

6.1 | Hypotheses 1a and 1b (sensory requirements and process virtualizability)

Hypotheses H1a and H1b argue that lesser SR will imply higher level of virtualizability. From the analysis, it was proven that the sensory characteristics of both activities (registration and written test) were all found to have a significant negative effect on citizens' willingness to register and write their exams respectively. This finding proves that citizens have placed less importance on the characteristics of the process. Based on the SR, our findings show that the activities are likely to be virtualized. Similarly, it becomes useful to virtualize the registration and written test activities. This finding seems important because it is aligned with previous research that established a significant negative impact of SR on process virtualizability (Balci, 2014b; Balci et al., 2013). Our results indicate that the sensory components with the license acquisition will be amenable to virtualization and probably reduce the rate of user resistance. A higher and positive SR would have meant that it will be difficult virtualizing the process.

6.2 | Hypotheses 2a and 2b (relationship requirements and process virtualizability)

Results show that while there is evidence to prove that the process characteristics of RR in the registration process were insignificant (β = −.080), those of the written test exams were significant (β = −.191; P < .05). Following the findings, the registration activity within the entire process of

acquiring a new drivers' license is not likely to be virtualized. This implies that citizens will prefer to "exploit the full potentials of their relationship characteristics by interacting and socializing with others in a professional context" (Ofoeda & Boateng, 2016). Though the findings seem surprising, it has been proven from past research that relationships that are purely virtual have the tendency to be frailer and less developed compared to physical relationships (Mesch & Talmud, 2006).

With respect to the written test process however, the results prove otherwise (β = −.191; P < .05). The reasoning based on this outcome is that "citizens do not place much importance on the characteristics of the process (written test), hence is highly amenable to virtualization" (Ofoeda & Boateng, 2016). The consistency of this result is seen in previous studies that have shown that RR contributed negatively to how buyers' user electronic channels to purchase goods (Overby & Konsynski, 2010) and how participants used airline check-in processes (Balci, 2014b). These findings tend to support what was originally proposed by Overby (2008).

6.3 | Hypotheses 3a and 3b (synchronism requirements and process virtualizability)

With respect to the process characteristics of the registration process, evidence proves that there is a significant negative impact on citizens' use of the internet to register for their services (license acquisition) (β = .093; P < .05). This result could be necessitated by the fact that citizens would like the registration process to be completed without any form of delay. Arguably, the delay occurs when, after starting the process online, it needed to be finalized manually by going to the designated offices of the DVLA.

Users who 1 way or the other attach more magnitude on the characteristic of the process were found to make the process less amenable to virtualization as in the case of hypothesis 3b. This result proves that in the case of the written test exams, it is unlikely for it to be conducted virtually with the synchronism characteristics in place. This finding contradicts prior research. For instance, Overby and Konsynski (2008) identified that synchronism requirements are negatively related to the way people use electronic markets. As the synchronism requirement has increased in this case, citizens will use less of the DVLA online written test. As such, it raises issues of resistance by the users. This finding is quite unexpected because most citizens would like to go through the written test exams with minimum or no delay. It seems to suggest that contextual differences (bahavior of users) (Sharma & Mishra, 2017) will hinder the virtualization of the process, which will give rise to corruption, because the synchronism requirement of the written test exams does not play any vital role in the virtualizability of the process, and hence, it means citizens would prefer to write the manual exams.

6.4 | Hypotheses 4a and 4b (ID and control requirements and process virtualizability)

The hypothesis for the registration activity predicted that the higher (lower) the identification and control requirements (IDC) of the registration process, the less (more) suitable it is to be conducted virtually. From the analysis, hypothesis 4a was not supported. This outcome is not surprising because past research acknowledges that identification and control requirements have stalled several processes from being virtualized. For instance, in the case of shopping process, most buyers find it difficult identifying the seller as a genuine provider of the products (Ba & Pavlou, 2002; Friedman & Resnick, 2001; cited in Overby & Konsynski, 2010). This result might be necessitated by the fact that they might be concerned about the misuse of the data they provide online. Similarly, they are cautious about privacy issues because virtual processes are "vulnerable to identity spoofing and control" (Overby & Konsynski, 2010). This result however contradicts prior studies (Balci et al., 2013; Balci & Rosenkranz, 2014; Overby & Konsynski, 2010). 2014 however revealed that identification and control requirements do not affect the virtualizability of the airline check-in process. It can be established that in the case of this study, identification and control requirements could not play any significant role in the process of registering; hence, it is not likely for it to virtualized.

Contrary to hypothesis 4a, hypothesis 4b proved otherwise. The outcome of this study reveals that identification and control requirements have a negative impact on citizens' use of the internet to write the DVLA written test. Identification and control requirement also significantly impacts the process of writing exams online (β = −.211; P < .01). This result is largely a confirmation to prior studies (Balci et al., 2013; Balci & Rosenkranz, 2014; Overby & Konsynski, 2008; Overby & Konsynski, 2010). Similarly, the results prove that citizens do not place much importance on the characteristics of the process; hence, it is likely for the process to be virtualized.

6.5 | Hypotheses 5a and 5b (sensory requirements, representations, and process virtualizability)

In reference to hypothesis 5a, it was established that representation was not able to contribute significantly to the process of registering (β = .00). This result proves that representation did not moderate SR and the virtualization of the registration process even though it has a positive moderating effect. This outcome is a little surprising because it was expected that the representation effect of IT will present customers with information relevant to the registration process which will reduce or eliminate the physical properties of SR (sight, sound, touch, etc.) (Overby, 2012). This outcome proves that customers place more importance on the characteristics of the process neglecting the characteristics of the virtualization mechanism (IT) hence making the process less useful to virtualization.

Conversely to the outcome of hypothesis 5a, hypothesis 5b proves a positive moderation effect of representation on the relationship between SR and the virtualizability process of the written test. The results (β = .193; P < .05) showed that representation had a positive influence between the independent variable (SR) and the dependent variable (virtualizability of the written test exams). This result is not different from past

studies that indicate that the effect of the Internet can reduce the physical interaction that is involved in processes (Barth & Veit, 2011). Similarly, the effect of IT can enable the virtualization of the written test process.

6.6 | Hypotheses 6a and 6b (relationship requirements, reach, and process virtualizability)

Both hypotheses 6a and 6b were not supported. Although the outcome is startling, it gives room for further in-depth investigation. The outcome of hypothesis 6a ($\beta = -.041$) did not corroborate the concepts and relationships that the PVT upholds. In this vein, it is difficult to tell whether the reason for the outcome is because IT makes the process better or worse. Similarly, hypothesis 6b states that there is a positive moderation effect of reach on the relationship between RR and process virtualizability. From the analysis, reach does not contribute positively to the model ($\beta = -.114$), although the entire construct was able to contribute significantly to the model at $P < .05$. The single contribution of reach is contrary to earlier findings (Balci, 2014b; Overby & Konsynski, 2010). According to Overby (2011), the PVT does not determine whether IT makes a process better or worse.

6.7 | Hypotheses 7a and 7b (ID and control requirements, monitoring and capability, and process virtualizability)

With respect to hypothesis 7a, there is a positive moderation effect of monitoring and capability between identification and control requirements and the virtualizability process of registration ($\beta = .083$). The result did not however contribute significantly to the entire model. Again, we find this result quite disturbing. Monitoring and control requirement as an IT construct is perceived to "authenticate process participants and track their activities" (Manoj, Costa, & Oliveira, 2015). In the case of the registration process, users can login to the online systems to go through the process of registration. The results show that the IT construct of monitoring and control do not matter to the customers when they want to register. Earlier, we found that identification and control requirements in the registration process were not supported. Arguably because of the risk of data misuse by unauthorized users, hence the ability of IT to provide authentication will not matter to customers. Layne and Lee (2001) and Alshehri and Drew (2010) have all suggested that privacy is 1 of the major barriers of most e-government projects in both developing and developed countries. Most past studies did not measure monitoring and capability as a construct (Overby & Konsynski, 2010). In lieu of this, there is arguably no existing literature to corroborate or otherwise contradict this finding.

Correspondingly, the moderation effect (monitoring and capability) on the virtualizability of the written test exams contributed negatively to process virtualizability, although it contributed significantly at $\beta = -.444$, $P < .01$, and the overall model was however significant at $P < .001$. To this effect, monitoring and capability was found to have a negative impact on citizens' use of the Internet to write the exams. Reasons for this result are largely similar to that of the registration process which involves misuse of data which might prevent users from exploiting the full potential of IT. As posited earlier, these findings with respect to the moderating effects are worrying. However, this might result from the context of this study (a developing country perspective).

7 | CONCLUSION

In general, this study contributes to the existing literature in the field of information systems and e-government research. The findings from this study support the call for blended or hybrid processes than a purely physical or virtual design (Robey, Schwaig, & Jin, 2003). Our position is further supported in the work of Li (2007) who suggested that most people would prefer to complete their online transactions (eg. banking) by physically visiting a bank branch to confirm the details of the deal and then complete the transactions in person.

This study also establishes important factors that influence the virtualizability of a G2C process. The study was also able to establish that the constructs of the PVT all have peculiar characteristics on the virtualizability of a process. From the 14 hypotheses tested, 6 were supported and provided valid evidence in demonstrating the applicability of the PVT. To the best of our knowledge, this study is the first that has fully tested all 7 constructs in the process virtualization theory within an African country context.

Arguably, most of the hypotheses were not supported because of the premium Ghanaians in general put on physical processes. It stands to reason that there are local contextual details within developing countries like Ghana that hinder the virtualization of government services. For instance, behavioral attributes such as personal relationship and socialization hinder the registration activity when acquiring a new driver's license. It is worth noting that these personal relationships to a large extent promote corruption in developing countries.

The study provides significant contributions to research, policy, and practice. For policy, governments could draw valid lessons from this study by first creating policies for testing the virtualizability of their services before migrating them online. This will minimize the massive failure of government online services. For research, the PVT has been chosen as the theoretical lens because it helped extend the knowledge about the factors that enable or hinder process virtualization in a government electronic service. In practice, because of the immerse benefits of virtualization, this study could provide practitioners with information on what users want online and how they can best design their virtual platforms. Specifically, practitioners can use the PVT to assess the amenability of varying processes under consideration by considering their process characteristics (Barth & Veit, 2011). In general, this study provides an empirical examination for the PVT that has rarely been tested because of its newness (Overby, 2012).

As with any other studies, this study is not exhaustive; hence, we provide directions for future research. First, future research can apply the PVT within other developing context to validate our findings. Second, future research can investigate the direct influence of the moderating constructs on process virtualizability because it was not the focus of this study. Third, future research could consider cloud computing and the process virtualization theory in e-government because it is evident many governments are also considering cloud computing (Fathey & Othman, 2014). Four, there seems to be a mismatch between what citizens demand and what governments seek to provide. Future research can investigate the cause of such mismatch.

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REFERENCES

Aladwani, A. (2016). Corruption as a source of e-government projects failure in developingcountries: A theoretical exposition. *International Journal of Information Management*, *36*, 105–112.

Alshawi, S., & Alalwany, H. (2009). E-government evaluation: Citizen's perspective in developing countries. *Information Technology for Development*, *15*(3), 193–208.

Alshehri, M., & Drew, S. (2010). Implementation of e-government: Advantages and challenges. Proceedings of the IASK International Conference E-Activity and Leading Technologies & InterTIC 2010.

Avgerou, C. (2008). New socio-technical perspectives of IS innovation in organizations. Information Systems and the Economics of Innovation.

Azmi, A. C., Kamarulzaman, Y., & Hamid, N. A. (2012). Perceived risk and the adoption of tax e-filing. *World Applied Sciences Journal*, *20*(4), 532–539.

Ba, S., & Pavlou, P. (2002). Evidence of the effect of trust building technology in electronic markets: Price premiums and buyer behavior. *MIS Quarterly*, *26*(3), 243–268.

Balci, B. (2014). The state of the art on process virtualization: A literature review. Twentieth Americas Conference on Information Systems, Savannah.

Balci, B. (2014b). The impact of perceived process characteristics on process virtualizability. Twenty Second European Conference on Information Systems. Tel Aviv.

Balci, B., Grgecic, D., & Rosenkranz, C. (2013). Why people reject or use virtual processes: A test of process virtualization theory. AMCIS 2013 Proceedings (2013). Retrieved from http://works.bepress.com/cristoph_rosenkranz/33

Balci, B., & Rosenkranz, C. (2014). Virtual or material, what do you prefer? Twenty Second European Conference on Information Systems. Tel Aviv.

Bannister, F., & Connolly, R. (2015). The great theory hunt: Does e-government really have a problem? *Government Information Quarterly*, *32*, 1–11.

Baron, R. M., & Kenny, A. D. (1986). The moderator–mediator variable distinction in social psychological research: Conceptual, strategic. *and statistical considerations. Journal of Personality and Social Psychology*, *51*(6), 1173–1182.

Barth, M., & Veit, D. (2011). Which processes do users not want online: Extending the process virtualization theory. Thirty Second International Conference on Information Systems, Shanghai 2011.

Begg, D., Langley, J., Brookland, R., McDowell, A., Ameratunga, S., & Broughton, J. (2009). The opinions of newly licensed drivers in New Zealand on the minimum car driver licensing age and reasons for getting a license. *Journal of the New Zealand Medical Association*, *122*(1306).

Begg, D., & Stephenson, S. (2003). Graduated driver licensing: The New Zealand experience. *Journal of Safety Research*, *34*, 99–105.

Begg, D. J., Langley, J. D., Brookland, R. L., & Ameratunga, S. (2014). Pre-licensed driving experience and car crash involvement during thelearner and restricted, licence stages of graduated driver licensing: Findings from the New Zealand Drivers Study. *Accident Analysis and Prevention*, *62*, 153–160.

Begga, D. J., Langley, J. D., Brookland, R. L., & Ameratunga, S. (2014). Pre-licensed driving experience and car crash involvement during thelearner and restricted, licence stages of graduated driver licensing: Findings from the New Zealand Drivers Study. *Accident Analysis and Prevention*, *62*, 153–160.

Berl, A., Race, N., Ishmael, J., & Meer, H. D. (2010). Network virtualization in energy-efficient office environments. *Computer Networks*, *54*, 2856–2868.

Bishop, M., & Wagner, D. (2007). Risks of e-voting. Communications of the ACM, 50.

Bohensky, M., Charlton, J., Odell, M., & Keeffe, J. (2008). Implications of vision testing for older driver licensing. *Traffic Injury Prevention*, *9*(4), 304–313.

Boughzala, I., Assar, S., & Romano, N. (2010). An E-government Field Study of Process Virtualization Modeling. Group Decision & Negotiation 2010. Delft - Netherlands.

Brooklanda, R., Begga, D., Langleya, J., & Ameratunga, S. (2014). Parental influence on adolescent compliance with graduated driverlicensing conditions and crashes as a restricted licensed driver: New Zealand Drivers Study. *Accident Analysis and Prevention*, *69*, 30–39.

Bruns, A., & Swift, A. (2011). g4c2c: A model for citizen engagement at arms' length from government. *Journal of eDemocracy*, *3*(1), 57.

Chan, F., Thong, J., Venkatesh, V., Brown, S., Hu, P., & Tam, K. (2010). Modeling citizen satisfaction with mandatory adoption of an e-government technology. *Journal of the AIS*, *10*(11), 519–549.

Chen, C. (2010). Impact of quality antecedents on taxpayer satisfaction with online tax-filing systems—an empirical study. *Information Management*, *47*, 308–315.

Christie, R. (2000). *Driver licensing requirements and performance standards including*. Australia: National Road Transport.

Connolly, A., & Judge, P. (2016). Process virtualization theory and social media's effects on the decision to volunteer. in AMCIS 2016, San Diego, USA 2016.

Dadzie, E. A. (2017). Corruption at DLA, GRA, Passport office 'Very real'—GII Survey. Retrieved 09 20, 2017, from Citifmonline.com: citifmonline.com/2017/03/08/corruption-at-DLA-GRA-Passport-office-''Very real''- GII Survey.

DeLaey, J. J., & Colenbrander, A. (2006). Visual standards: Vision requirements for driving safety with emphasis on individual assessment. Report prepared for the International Council of Ophthalmology.

Effah, J., & Nuhu, H. (2017). Institutional barriers to digitalization of government budgeting in developing countries: Case study of Ghana. *EJISDC*, *82*(5), 1–17.

Fathey, M., & Othman, I. (2014). A survey on cloud government models. 1st International Conference of recent trends in information and communication technologies, (pp. 134–143).

Feng, L. (2003). Implementing e-government strategy is and emerging issues. *Scotland: Current Situation Journal of Electronic Commerce in Organizations*, *1*(2), 44–65.

Følstad, A., Jørgensen, H. D., & Krogstie, J. (2004). User involvement in e-government development projects. Paper presented at NordCHI 2004. Tampere, Finland.

Fong, J., Kwan, R., Wang, F., Huang, R., Ma, D., & Zhang, H. (2008). Towards a design theory of blended learning curriculum. Hybrid Learn. Ed., 5169, 66–78.

Friedman, E. J., & Resnick, P. (2001). The social cost of cheap pseudonyms. *Journal of Economics and Management Strategy*, *10*(2), 173–199.

Gichoya, D. (2005). Factors affecting the successful implementation of ICT projects in government. *The Electronic Journal of e-Government*, *3*(4), 175–184.

Goodhue, D., Lewis, W., & Thompson, R. (2007, June). Research note—statistical power in analyzing interaction effects: Questioning the advantage of PLS with product indicators. *Information Systems Research*, *18*(2), 211–227.

Graupner, E., & Maedche, A. (2015). Process digitisation in retail banking: An empirical examination of process virtualization theory. *International Journal of Electronic Business*, *12*(4), 364–379.

Hair, J. (2010). *Multivariate Data Analysis* (7 ed.). Prentice Hall.

Hirsch, P., Maag, U., & Laberge-Nadeau, C. (2006). The role of driver education in the licensing process in Quebec. *Traffic Injury Prevention*, *7*, 130–142.

Hung, S. Y., Chang, C. M., & Kuo, S. R. (2013). User acceptance of mobile e-government services: An empirical study. *Government Information Quarterly*, *30*, 33–44.

Kim, C., Galliers, R. D., Shin, N., Ryoo, J.-H., & Kim, J. (2012). Factors influencing Internet shopping value and customer repurchase intention. *Electronic Commerce Research and Applications*, *11*, 374–387.

Kim, J. S., Kaye, J., & Wright, L. K. (2001). Moderating and mediating effects in casual models. *Issues in Mental Health Nursing*, *22*, 63–75.

Koppius, O. R., Van Heck, E., & Wolters, M. J. (2004). The importance of product representation online: Empirical results and implications for electronic markets. *Decision Support Systems*, *38*(2), 161–169.

Krishnan, S., Teo, T., & Lim, V. (2013). Examining the relationships among e-government maturity, corruption, economic prosperity and environmental degradation: A cross-country analysis. *Information Management*, *50*, 638–649.

Layne, K., & Lee, J. (2001). Developing fully functional e-government: A four stage model. *Government Information Quarterly*, *18*, 122–136.

Li, F. (2007). What is e-business and does it still matter. *International Journal of Information Technology and Management*, *6*(2/3/4).

Likert, R. (1932). A technique for the measurement of attitudes. Archives of Psychology.

Maedche, A., & Graupner, E. (2015). Process digitalization in retail banking: An empirical examination of process virtualization theory. *International Journal of Electronic Business*, *12*, 364–379.

Manoj, T., Costa, D., & Oliveira, T. (2015). Assessing the role of IT-enabled process virtualization on green IT adoption. *Information Systems Frontiers*.

Mastena, S. V., Fossb, R. D., & Marshall, S. W. (2013). Graduated driver licensing program component calibrations and their association with fatal crash involvement. *Accident Analysis and Prevention*, *57*, 105–113.

Mayhew, D. R., Simpson, H. M., & Singhal, D. (2005). Best practices for graduated driver licensing in Canada. Traffic Injury Research Foundation.

Mesch, G., & Talmud, I. (2006). The quality of online and offline relationships: The role of multiplexity and duration of social relationships. *The Information Society*, *22*(3), 137–148.

Moore, G. C., & Benbasat, I. (1991). Development of an Instrument to Measure the Perceptions of Adopting an Information Technology Innovation. *Information Systems Research*, *2*(3), 192–222.

Ofoeda, J., & Boateng, R. (2016). Factors that constrain or inhibit virtualization in a government-to-citizen. Twenty-second Americas Conference on Information Systems, San Diego, 2016. San Diego.

Overby (2012). Information systems theory: Explaining and predicting our digital society. In Y. K. Dwivedi, M. R. Wade, S. L. Schneberger, Y. K. Dwivedi, M. R. Wade, & S. L. Schneberger (Eds.), ()*Integrated Series in Information Systems*. Dordrecht Heidelberg London: Springer New York. https://doi.org/10.1007/978-1-4419-6108-2

Overby, E. (2008). Process virtualization theory and the impact of information technology. *Organization Science*, *19*(2), 277–291. https://doi.org/10.1287/orsc.1070.0316.

Overby, E. (2011). Migrating processes from physical to virtual environments: Process virtualization theory. Information Systems Theory: Explaining and Predicting Our Digital Society, 1. Retrieved from Springer Science + Business Media LLC, 2011.

Overby, E., & Konsynski, B. (2010). Task-technology fit and process virtualization theory: An integrated model and empirical test. Emory Public Law Research, 10–-96. Retrieved from http://ssrn.com/abstract=1567097or DOI: https://doi.org/10.2139/ssrn.1567097.

Overby, E., Slaughter, S., & Konsynski, B. (2010). The design, use, and consequences of virtual processes. *Information Systems Research*, *21*(4), 700–710.

Overby, M., & Konsynski, B. (2008). Process virtualization: A theme and theory for the Information Systems Discipline. Retrieved November 04, 2013, from http://ssrn.com/abstract=1138045

Pallant, J. (2007). *SPSS Survival Manual: A step by step guide to data analysis using SPSS for windows* (t. ed.). England: McGraw-Hill Education.

Pallant, J. (2011). *SPSS survival manual : a step by step guide to data analysis using SPSS*. (4. edition, Ed.) Crows Nest NSW 2065, Australia.

Ramus, K., & Nielsen, N. A. (2005). Online grocery retailing: what do consumers think? *Internet Research*, *15*(13), 335–352.

Robey, D., Schwaig, K. S., & Jin, L. (2003). Intertwining material and virtual work. *Information and Organization*, *13*(2), 111–129.

Saltz, J. S., Hiltz, S. R., Turoff, M., & Passerini, K. (2007). Increasing participation in distance learning courses. IEEE Internet. *Computertomographie*, *11*(3), 36–44.

Sarrayrih, M., & Sriram, B. (2015). Major challenges in developing a successful e-government: A review on the Sultanate of Oman. Journal of King Saud University – Computer and. *Information Sciences*, *27*, 230–235.

Schaupp, L. C., & Carter, L. (2005). E-voting: From apathy to adoption. *Journal of Enterprise Information Management*, *18*(5), 586–601.

Schaupp, L. C., Carter, L., & McBride, M. E. (2010). E-file adoption: A study of U.S. taxpayers'' intentions. *Computers in Human Behavior*, *26*, 636–644.

Schwester, R. W. (2009). Examining the barriers to e-government adoption. *Electronic Journal of e-Government*, *7*(1), 113–122.

Sharma, R., & Mishra, R. (2017). Investigating the role of intermediaries in adoption of public access outlets for delivery of e-government services in developing countries: An empirical study. *Government Information Quarterly*, *34*, 658–679.

Shu, J., Li, B., & Zheng, W. (2005, February). Design and implementation of a storage virtualization system based on SCSI target simulator in SAN. *Tsinghua Science and Technology*, *10*(1), 122–127.

Snead, J. T., & Wright, E. (2014). E-government research in the United States. *Government Information Quarterly*, *31*, 129–136.

Soufi, B., & Maguire, M. (2007). Achieving Usability Within E-Government Web Sites Illustrated by a Case Study Evaluation. Symposium on Human Interface and the Management of Information. Interacting in Information Environments. Human Interface 2007. Lecture Notes in Computer Science (pp. 777–784). Berlin, Heidelberg: Springer.

Velsen, L. V., Geest, T. V., Hedde, M. T., & Derks, W. (2009). Requirements engineering for e-Government services: A citizen-centric approach and case study. *Government Information Quarterly*, *26*, 477–486.

Verkijika, S., & Wet, L. (2018). A usability assessment of e-government websites in sub-Saharan Africa. *International Journal of Information Management*, *39*, 20–29.

Williams, A. F., Tefft, B. C., & Grabowski, J. G. (2012). Graduated driver licensing research, 2010-Present. *Journal of Safety Research*, *43*, 195–203.

Yildiz, M. (2012). Big questions of e-government research. *Information Polity*, *17*(3–4), 343–355.

Zhang, H., Xu, X., & Xiao, J. (2014). Diffusion of e-government: A literature reviewand directions for future directions. *Government Information Quarterly*, *31*(4), 631–636.

Zhang, Y., Li, Y., & Zheng, W. (2013). Automatic software deployment using user-level virtualization for cloud-computing. *Future Generation Computer Systems*, *29*, 323–329.

Zhua, M., Chub, H., & Li, G. (2009). Effects of graduated driver licensing on licensure and traffic injury rates in Upstate New York. *Accident Analysis and Prevention*, *41*, 531–535.

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