Communications of the Association for Information Systems

5-2018

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Abstract:

Most research on the impact of enterprise resource planning (ERP) systems implementation on business process outcomes have focused on developed nations. However, Sub-Saharan Africa, a developing region, is a growing ERP market and provides a new context for theory development. We examine the antecedent and outcomes of extent of ERP systems implementation in Sub-Saharan Africa. Specifically, we examine three research questions: 1) "How does an organization's data culture influence the extent of ERP implementation?", 2) "How does the extent of ERP implementation influence the ethical behavior and data integration of the organization?", and 3) "How do ethical behavior and organizational integration influence the business process outcomes?". We used the panoptic concept as a theoretical lens to develop a research model and six hypotheses to answer the research questions. We tested the model by using the survey methodology to collect data from 115 firms that have implemented ERP systems and operated in 13 industries in Ghana, a Sub-Saharan Africa nation. We used structural equation modeling to analyze the data. We found support for all six hypotheses. We offer both theoretical and managerial implications.

Keywords: Extent of ERP Implementation, Business Process Outcomes, Sub-Saharan Africa, Panoptic, Ethical Behavior, Data-driven Culture, Organizational Integration.

1   Introduction

Enterprise resource planning (ERP) systems implementation engenders both tangible and intangible benefits such as enhancing visibility and accessibility of information across an organization in an integrated environment (Murphy & Simon, 2002). ERP impact studies primarily focus on developed nations, particularly North America and Europe, which feature massive adoption of ERP systems (Bailey, Seymour, & Van Belle, 2017; Huang, Hung, Chen, & Ku, 2004). However, with recent economic growth in many Sub-Saharan Africa (SSA) nations, ERP vendors have found these economies to be key markets, which has resulted in a rise in ERP systems implementation in this region (Bailey et al., 2017). Asamoah, Andoh-Baidoo, and Agyei-Owusu (2015) replicated Karimi, Somers, and Bhattacherjee's (2007a) study on the relationship between extent of ERP implementation and business process outcomes in a SSA nation. They found consistent measurement models but different structural models between the two studies. They attributed the differences to their excluding contextual variables that prevailed in the study's context, which supports prior work that asserts that context influences ERP implementation (Kouki, Poulin, & Pellerin, 2009). Other scholars and institutions have noted that corruption (Transparency International, 2012), a poor data-driven culture (Asamoah, 2014; McAfee & Brynjolfsson, 2012), and poor organizational control (Asamoah, 2014; Mbarika, Okoli, Byrd, & Datta, 2005; McDade & Spring, 2005) constitute major environmental challenges to the extent to which organizations implement IT in the SSA region.

Thus, we investigate:

RQ1: How does data-driven culture influence the extent of ERP implementation in SSA?

RQ2: How does the extent of ERP implementation influence ethical behavior, organizational integration and business process outcomes?

RQ3: How do ethical behavior and organizational integration influence business process outcomes?

Based on the panoptic concept (Botan, 1996; Elmes, Strong, & Olga, 2005; Zuboff, 1988), we contend that, in the SSA context, an organization's data-driven culture serves as an antecedent to the extent of ERP implementation, which, in turn, leads to greater organizational integration and high ethical behavior— both of which lead to positive business process outcomes. We tested the research model using empirical data from 115 firms in Ghana, a SSA nation. We used the partial least squares method to structural equation modeling (PLS-SEM) to analyze the data.

We chose Ghana for several reasons. First, Ghana was among the first nations to have Internet access in the SSA region (Foster, Goodman, Osiakwan, & Bernstein, 2004). Second, successive governments in Ghana have sought to more quickly develop the country through diverse economic reforms and liberalization programs that focus on building infrastructure and capacity, accelerating economic growth, and increasing the social welfare of Ghanaians (Amoako-Gyampah & Acquaah, 2008). Third, Ghana has enjoyed an extended period of political stability, which has garnered recognition and praise from several bodies (Langdon, 2011). Fourth, the country has experienced significant growth in the banking and telecommunication sectors, which has led to the development of a vibrant ICT base. Ghana was one of the only two African countries considered among future IT outsourcing locations and placed ahead of countries such as Korea, Malaysia, Mauritius, Nepal, Senegal, Sri Lanka, Taiwan, and Thailand (Davis, Ein-Dor, King, & Torkzadeh, 2006). Ghana now boasts of a vibrant ICT outsourcing industry with several organizations that provide outsourcing and offshoring business processes to local and international markets (Oppong, 2014).

The paper contributes to both theory and practice. For theory, we demonstrate how ethical behavior, organizational integration, and data-driven culture variables are critical in explaining the relations between the extent of ERP implementation and business process outcome in SSA context; by doing so, we strengthen theory on ERP impacts (Dennis & Valacich, 2014; Kouki et al., 2009). Understanding the impact of ERP systems in the SSA nations should be of interest to both practitioners and academics because it presents a new and significantly different context (Roztocki & Weistroffer, 2009, 2011). Second, scholars have noted that ethics is an important topic in information systems research (Mingers & Walsham, 2010). Hence, others can replicate or expand the model we propose in other contexts to build cumulative research on ERP, BPO, and ethics. Third, by applying the panoptic perspective, we better explain how ERP systems afford organizations the ability to control employee activities and enforce appropriate ethical behaviors. All three contributions lead to our building context-specific theorizing, which is a key mechanism for theory development (Hong, Chan, Thong, Chasalow, & Dhillon, 2014). For

practice, we suggest that organizations can benefit from a wider extent of ERP implementation because such endeavor can serve as a mechanism that causes employees to be mindful of expected ethical behavior when using ERP or integrated systems; actions that lead to positive business process outcomes. Second, an organization's data-driven culture drives the need for greater extent of ERP implementation engendering high ethical behavior, high organizational integration, and positive business process outcomes. Third, we expand our understanding and contribute to improving the success of ERP implementations and ICT adoption in general in the SSA region (Bagchi, Udo, & Kirs, 2007; Musa, Meso, & Mbarika, 2005).

This paper proceeds as follows. In Section 2, we present relevant literature on impact of ERP implementation on business process outcomes and challenges to ERP implementations in SSA. In Section 3, we present theoretical background, research model and hypotheses. In Section 4, we describe the research methodology and data analysis. In Section 5, we present the results. Finally, in Section 6, we discuss our findings and the study's implications and limitations.

2 Relevant Literature Review

2.1 Impact of ERP Systems on Business Process Outcomes

Researchers have measured the impact of ERP systems at both the business process and organizational levels (Elbashir, Collier, & Davern, 2008; Karimi et al., 2007a; Wieder, Booth, Matolcsy, & Ossimitz, 2006). At the process level, business process outcome (BPO) and business process performance (BPP) are two different terminologies that researchers have used to assess the impact of ERP implementations. However, they have defined BPO and BPP in the same way (Elbashir et al., 2008; Karimi et al., 2007a); namely, as business value creation by IT systems through three separate but complementary effects (automational, informational, and transformational) on business processes that eventually result in operational efficiency and effectiveness. In this study, we use business process outcomes as synonymous with business process performance. Table 1 summarizes the research on the impact of ERP implementations at the business process and organizational levels. The table indicates that majority of the studies focused on developed nations using the resource-based view of the firm as the theoretical lens. While several studies assessed the impact of ERP implementation at both the process and firm level, some such as Karimi et al. (2007a) and Karimi, Somers, and Bhattacherjee (2007b) focused only on the process level. Most of the studies found a positive relationship between the process level impact and firm level impact. Thus, in our study, to achieve parsimony, we focus on the process level outcomes with BPO as our dependent variable (Karimi et al., 2007a). We also employ panoptic theory as a lens to provide new insights on the influence of context of the SSA region on the impact of ERP systems implementation at the business process level.

2.2 ERP Implementation and the Sub-Saharan Africa Environment

The extant literature indicates that poor business ethics of owners and managers, a poor organizational data-driven culture, and high functional divisions present peculiar challenges with ERP implementations in the SSA region (Asamoah, 2014; Heeks, 2007; Otieno, 2005). The typical business owner-manager in SSA is usually short-sighted with little or no interest in making long-term investments, reluctant to open up their business operations to potential stakeholders, unwilling to be constrained by an ERP system or organizational rules, desirous of operating autonomously in order to run the business as best suits them, and as harboring a desire to take total control over their organization (Agboli & Ukaegbu, 2006; Asamoah, 2014; McDade & Spring, 2005). These attitudes negatively affect firms' business process performance (Al-Jabri & Roztocki, 2010).

The impact of ERP implementation success is negatively affected when employees misconstrue business processes, circumvent laid down procedures, use the system for their personal gain, willfully commit errors in their work, or perform unethical and corrupt practices (Asamoah, 2014; Beugré & Offodile, 2001; McDade & Spring, 2005). Since ERPs are integrated end-to-end systems software, their successful implementation in a firm depends on the behavior and attitude of the system's users (Freeman, 1984). Some owners perceive the implementation of integrated information systems as a threat due to the system's ability to disclose information (Asamoah, 2014; Erat, Desouza, & Schäfer-Jugel, & Kurzawa, 2006; Mahdavian et al., 2012).

Table 1. Relevant Studies on Impact of ERP Systems on Business Process Outcomes

Author(s) and country	Purpose	Constructs	Theory used	Methodology	Findings
Dehning & Richardson (2002) USA	Created a model to guide future studies in IT investment' assessment	Model posited that IT impacts on business process (BP) and latter impact on firm performance (FP)		- Archival studies of accounting or market measures of FP	- Identified three paths between IT and FP: 1) direct link between IT & FP, 2) link between IT and BPP, and 3) the link between BPP and FP. - Path 4 looked at contextual factors that influence the link between BPP and FP
Wieder et al. (2006) Australia	Examined impacts of aspects of ERP adoption on business process and firm performances	ERP impacts on both supply chain process management (SCMP) and firm performance (FP). SCMP also impacts on FP.		- Survey methodology - Used financial and SCOR model for impact study - CIOs as respondents - Received 68 usable responses (1st stage-mail) - Received 102 responses from phone survey (2nd)	- No significant difference between adopters and non-adopters on the impact of the system at both the overall firm level or at the business process level (SCMP level) - Positive impact on FP in the long run but not the same effect at the business process level
Karimi et al. (2007a) USA	Examined the contextual conditions under which extent of ERP implementation has the greatest effect on BPO	Extent of ERP implementation, BPO, ERP radicalness & ERP delivery system are moderators	Technological diffusion perspective & Resource Based View Theory (RBV)	-Survey methodology -Pilot study was used for instrument validation and refinement -Respondents were high-ranking IS executives - PLS was used for the data analyses	- Results confirmed that the extent of ERP implementation impacts BPO, and both ERP radicalness and delivery systems play moderating roles
Karimi et al. (2007b) USA	Assessed the complementary effect of the link between IS resources and ERP capabilities on BPO	IS resources impact ERP capabilities, which, in turn, impact BPO	RBV	- Survey methodology - Pilot study was used for instrument validation and refinement - Respondents were high-ranking IS executives - PLS was used for the data analyses	1) Hypothesized model supported 2) Findings indicated that knowledge resources are the most critical resource for building ERP capabilities, followed closely by relationship resources, and, finally, infrastructure resources 3) Co-presence effect arises from a synergy of multiple IS resources
Elbashir et al. (2008) Australia	Tested the links between business intelligence (BI), business process performance (BPP) and organizational performance (OP)	BI impacts on the BPP, and the BPP in turn impacts on OP	Porter's value chain activities framework	- Survey methodology - Respondents included senior business and IT executives - 419 usable responses from 212 firms - PLS was used for the data analyses.	- Results confirmed significant relationship between BPP and OP - Significant differences exist in the strength of the relationship between the different sectors
Uwizeyemungu & Raymond (2012) Canada	Unearthed the possible link between key ERP system characteristics (ERP capabilities), and its contribution to organizational performance.	Model depicted the influence of ERP capability on business process, with the latter impacting on ERP business value	RBV	- Positivist multiple case study (manufacturing firms) - 25 in-depth interviews of various managers, including the firm's CIO - Atlas.ti qualitative data analysis software	- Study supported assertion that key ERP capabilities are critical in their contribution to organizational performance through the business process

Table 1. Relevant Studies on Impact of ERP Systems on Business Process Outcomes

Oseni, Rahim, Foster, & Smith (2013) Australia	Examined the effect of ERP post-implementation modifications on business process optimization	A model relating ERP modifications with business process outcomes	ERP-PIM made up of organizational motivation, organizational learning and RBV of the firm	- Critical realist approach - Exploratory case study - Data collected from multiple source including in-depth interviews with two key respondents - Propositions evaluated using pattern matching	-ERP post-implementation modification initiatives are influenced by organizational motivation and learning -Business process optimization largely depends on ERP capability
Chen (n.d.) China	Investigated the effect of ERP systems competences and business process performance on organizational performance	Model depicted the influence of ERP systems competence on BPP and latter effect on organizational performance	Process-oriented approach and RBV	- Survey methodology - Multiple responses in each organization, including CFO, CIO and ERP systems users - PLS SEM was used for the analysis	Findings indicate that business process performance is an important factor that mediates the relationship between ERP systems competences and organizational performance

ERP systems are programmed to streamline the whole range of activities of a firm and promote coordination and collaboration between all of its key functional areas. However, in SSA region and other developing countries, many firms do not have fully operational functional areas (Abdelghaffar & AbdelAzim, 2010; Asamoah, 2014), so ERP implementation appears unnecessary to owners of small businesses (Lusby, 2009).

McAfee and Brynjolfsson (2012 p. 6) note that "the more companies characterized themselves as data-driven, the better they performed on objective measures of financial and operational results". Thus, being data-driven is key to enhancing organizational performance (McAfee & Brynjolfsson, 2012). The data-driven culture of most indigenous firms in the SSA region appears to be very poor. Organizations and their owners, managers, employees, and government institutions place less value on data as a strategic tool in their operations and decision making (Baldwin & Diers, 2009). Some organizations rarely conduct market surveys, analyze past data trends to predict future growth patterns, or use data as the basis for decision making. The culture of effective data-driven decision making is not prevalent in majority of indigenous SSA businesses as compared to developed nations (Asamoah, 2014; Koh, Soh, & Markus, 2000). The underdeveloped data usage culture of businesses serves as a barrier to ERP implementation, acceptance, and usage in SSA.

Most managers in SSA seem more interested in using only some specific parts of the system (usually the financial report-generation tools, invoicing, and inventory replenishment functions) (Asamoah, 2014; McDade & Spring, 2005). One main reason for why many firms fail to fully operationalize their ERP systems concerns their owner-managers' unwillingness to make the wholesale changes to their business operations that ERP implementation may require (Asamoah 2014; Seethamraju & Seethamrajum 2008). Most managers faced with this conundrum just opt to implement specific modules of the ERP to adjust the ERP systems as best as possible to fit their current operations and, by so doing, avoid reengineering their business process. However, doing so leads to firm's inability to fully achieve ERP's business process outcomes (Karimi et al., 2007a).

The data culture, ethical behavior, and organizational integration factors influence successful ERP implementations in SSA countries. If not properly considered, these factors could erode the benefits that SSA businesses expect from ERP systems implementation—they could even cause the ERP implementation to fail and firms (especially in SSA and developing countries) to perform poorly. We argue that positive data culture, ethical behavior, and functional integration influence whether firms in SSA successfully implement and use ERP systems.

3   Theoretical Background

3.1   The Panoptic Concept in Information Systems Research

We employ the panoptic concept as a lens to investigate the influence of contextual variables on the extent of ERP implementation and BPO.

Foucault (1977) developed the panoptic concept by observing Bentham's panopticon. The panopticon—a proposed prison structure to provide constant surveillance of inmates—would allow wardens to observe

prisoners who could not tell when and if they were under observation. This caused prisoners to behave as if they were under constant surveillance, ensuring control and self-discipline. This effect of panopticism allows prisons to observe and supervise prisoners less (Foucault, 1977).

Elmes et al. (2005) applied the concept of panopticism in IT research by borrowing the concept of Foucauldian disciplinary power to provide the two theoretical perspectives of panoptic empowerment and reflective conformity. Zuboff (1988) also applied the panoptic concept to IT and suggested that the IT, and not a physical structure, provides the gaze. As such, IT systems can ensure organizational control. Modern surveillance systems can impose a panoptic relationship and introduce "compartmentalization" of the workers without the need for walls or borders (Botan, 1996). This "information panopticon" frees management control from the constraints of time and space (Zuboff, 1988).

Researchers have compared enterprise-wide information visibility to the concept of panopticism because it renders worker activities transparent to the employer, much like the open cells visible in Bentham's original design and, thus, exerts a panoptic control on employees to behave in acceptable ways. Large-scale IT implementations such as ERP systems increase information visibility across different strata in organizations. Also, everyone can see/access information, which enables them to better control processes and outcomes (Elmes et al., 2005).

3.2   Research Model and Hypotheses

After conducting a replication study in Ghana, Asamoah et al. (2015) suggest that absence of the contextual variables may explain the differences in structural models between their own and Karimi et al.'s (2007a) findings. Asamoah et al.'s measurement model results support the relevance of the constructs in Karimi et al. (2007a) in the SSA context, but the structural model was relatively poor in the SSA context, which suggests the need to examine a modified model in the new context (Asamoah, 2014; Mbarika et al., 2005; McDade & Spring, 2005). The study we present here examines the influence of contextual variables in understanding relationships between extent of ERP implementation and business process outcomes (Asamoah, 2015; Karimi et al., 2007a). Appendix 1 contains the constructs we used in this study, the type of construct (formative or reflective), the items we used to measure the constructs, and where we adapted them from.

The model we propose considers how ethical forces play a significant role in ERP implementations in SSA firms. We identify explore two ethical behaviors in this study: organizational control and corruption. Cardinal (2001) defines organizational control as the process by which a firm's managers direct attention, motivate, and encourage organizational members to act in desired ways to meet the firm's objectives. One can use organizational control to check deviance in work processes and cooperation among members (Grabski & Leech, 2007; Lange, 2008). Ashford and Anand (2003) define corruption as "acting corruptly" and, in connection to organizations, they define it as "the misuse of authority for personal, subunit and or organizational gain" (p. 2). Further, many regions suffer from corruption: for example, Ashforth, Gioia, Robinson, and Trevino (2008) found that the leaders of major U.S. corporations allowed corrupt practices, which led to their collapse. However, researchers and others have identified the SSA region as among the most corrupt regions in the world; indeed, several of its countries have scored below 50 points on the perceived corruption index (Transparency International, 2012).

We argue that a data-driven culture is an important factor when considering ERP implementation in the SSA region. Data culture, as stipulated in the framework, refers to the usefulness and importance placed on the data generated in an organization (McAfee & Brynjolfsson, 2012). We postulate that the demand for data, appreciation of data, and use of data in the organization will directly influence the extent of ERP Implementation.

The research model includes the level of integration of the different functional units of the organization. For our purposes here, we adopt Lawrence and Lorsch (1967, p. 34) definition of organizational integration as "the process of achieving unity of effort among the various subsystems in the accomplishment of the organization's tasks". This definition highlights the coordinated and synchronized way an organization's different departments must work together. By integrating these functional areas, firms can achieve this coordination. Hence, organizations need to appreciate the integration of its functional departments to ensure that they achieve ERPs' benefits. We present the research model in Figure 1.
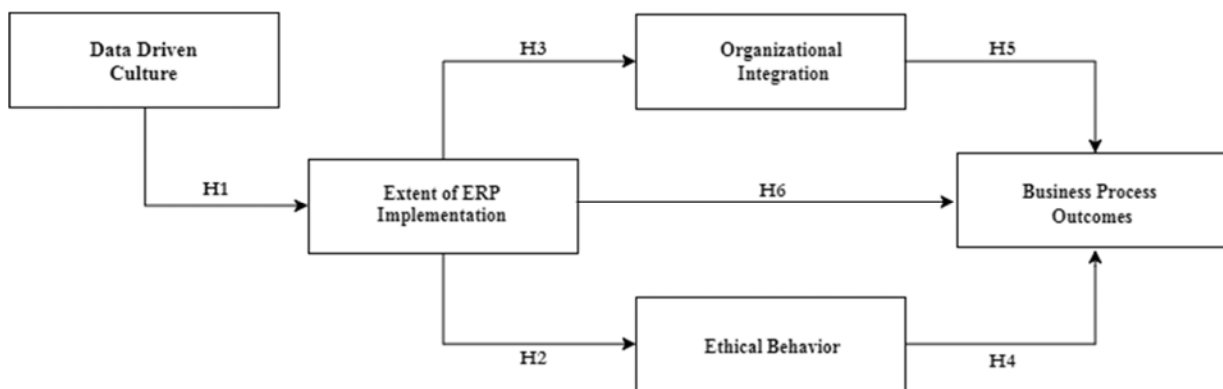
Figure 1. Research Model

3.2.1   Data-driven Culture and Extent of ERP Implementation

An organization's data-driven culture influences its extent of ERP implementation. First, the ERP system provides panoptic control in the organization through the IS infrastructure and platform that enables enterprise-wide, visible, and integrated information (Asamoah, 2014; Ravichandran & Lertwongsatien, 2005). Greater demand for data-driven decisions support larger extent of ERP implementation, and a weak data culture would limit extent of ERP implementation (Asamoah, 2014; Ravichandran & Lertwongsatien, 2005). Firms with an excellent existing data-driven culture should demand a greater extent of ERP implementation than firms with poor data-driven culture. Thus, we hypothesize:

> **H1:** A greater data-driven culture is positively associated with a greater extent of ERP implementation.

3.2.2   Extent of ERP Implementation and Ethical Behavior

A greater extent of ERP implementation would result in greater ethical behavior in SSA organizations. IT influences employees' behavior (Khoumbati, Themistocleous, & Irani, 2006; McGinnis, Pumphrey, Trimmer, & Wiggins, 2004) by forcing them to comply. From the panoptic perspective, ERP systems provide firm-wide visibility, which renders worker activities transparent to employers. This transparency imposes a measure of panoptic control over worker's behavior (Elmes et al., 2005). Other researchers have also confirmed IT systems' ability to enforce control has also been confirmed (Bertot, Jaeger, & Grimes, 2010; Shim & Eom, 2009). It is believed that greater extent of ERP implementation results in greater organizational control (Asamoah, 2014; Ashforth et al., 2008; Campbell, 2007). Firms can use ERP systems to control corruption by providing visibility on the institutional processes. An ERP system not only enhances transparency particularly at the transactional level but also creates opportunities for easier access to organizational data and establishes linkages among geographically separated systems for better accountability (Olla, Onabanjo, & Ajisegiri, 2012). Consequently, the "gaze" that the ERP provides serves as a mechanism that encourages employees to avoid corrupt practices and other unethical acts. A greater extent of ERP implementation increases the ability to detect and punish corruption and enforce organizational control (Asamoah, 2014; Luo, 2005). Thus, we hypothesize:

> **H2:** A greater extent of ERP implementation is positively associated with greater ethical behavior.

3.2.3   Extent of ERP Implementation and Organizational Integration

Scholars have noted that ERP implementation ensures organizational integration and results in greater coordination, collaboration, and communication among individuals, teams, and departments in an organization (Barki & Pinsonneault, 2002; Koufteros, Rawski, & Rupak, 2010). From the panoptic perspective, greater integration will facilitate visibility of employees' activities and tighter control of information processing practices. ERP systems provide information visibility that helps firms to streamline organizational operations, break down the inter-departmental walls, and enable real-time firm-wide information sharing. According to the panoptic concept, providing a single location from which one can manage and monitor enterprise-wide data benefits organizations. In fact, researchers have termed ERP systems as exemplifying technological integration because they allow one to unify data from diverse functional areas in a single database (Escobar-Rodriguez, Escobar-Perez, & Monge-Lozano,` 2014).

Thus, the extent to which an organization implements its ERP across functional, organizational, and geographic scopes influences the extent to which it integrates ERP. We postulate that the extent to which a firm implements ERP informs the level of organizational integration that the organization achieves. The greater the extent of ERP implementation, the greater the organizational integration that the firm achieves. Thus, we hypothesize:

H3: A greater extent of ERP implementation is positively associated with greater organizational integration.

3.2.4   Ethical Behavior and Business Process Outcomes

Negative behaviors, attitudes, and actions of a firm's stakeholders can have a direct and negative impact on the firm's performance. Researchers have widely acknowledged corruption's negative effects on organizations; corruption is associated with inefficiency, reduced financial performance, reduced economic growth, and increased rates of poverty and inequality (Campbell, 2007; Doh, Rodriguez, Uhlenbruck, Collins, & Eden, 2003). Widespread corruption, negative work ethics, and poor organizational control by business owners, managers, and employees scupper the success of ERP implementations and reduce the process and organizational level benefits firms realize from ERP implementations (Sarin & McDermott, 2003). ERP systems can exert panoptic influences on members of the organization and establish organizational control and orderliness, which reflects positively on process improvement. Thus, we hypothesize:

H4: Greater ethical behavior is positively associated with greater business process outcomes.

3.2.5   Organizational Integration and Business Process Outcomes

Scholars have suggested that organizations reap significant benefits from their IS initiatives when the IS implementation is integrated with the organization's value-chain activities (Karimi, Somers, & Bhattacherjee, 2007b; Santhanam & Hartono, 2003). By implementing ERP systems, organizations can streamline their core value-chain activities, improve the flow of information, and reap significant business process improvements and costs (Alshawi, Themistocleous, & Almadani, 2004; Karimi et al., 2007a). By automating business processes and facilitating business process change, ERP systems could help organizations reduce cycle times, increase productivity, and improve quality and customer service (Rajagopal & Tyler, 2002). Such an integrated system supports the panoptic perspective because it enables information and operational visibility. We conceptualize that the improved process and functional integration would result in greater BPO. Thus, we hypothesize:

H5: Greater organizational integration is positively associated with greater business process outcomes.

3.2.6   Extent of ERP Implementation and Business Process Outcomes

We explore the relationship that exists between extent of ERP IMPLEMENTATION and BPO. From the panoptic concept perspective, a greater extent of ERP implementation would not only facilitate business process change, which will empower the organizations to reduce cycle times, and increase productivity and improve quality and customer service (Rajagopal, 2002). However, it would eventually cause the IS to have an organization-wide surveillance system that allows organizational members and, more especially, management to effectively monitor operations with the goal of improving efficiencies and effectiveness, which, in turn, would lead to enhanced BPO. Researchers have shown that a greater extent of ERP implementation is likely to result in firms reaping better results in terms of business process outcomes (Fichman, 2004; Karimi et al., 2007a; Loukis, Sapounas, & Milionis, 2009). Thus, we hypothesize:

H6: A greater extent of ERP implementation is positively associated with greater business process outcomes.

4   Research Methodology

4.1   Instrument Development

We collected data using a survey instrument that largely included measures from existing literature. Where we found no existing items, we used relevant extant studies to develop new items. For some constructs, we carefully self-developed items using MacKenzie, Podsakoff, and Podsakoff's (2011)

elaborate scale-development process. For example, we systematically developed and validated measures for the first-order "organizational control" and "corruption" dimensions of "ethical behavior" based on guidelines and exemplars from MacKenzie et al.'s (2011) scale-development techniques.

The structure of the questionnaire ensured respondents could easily read and understand it. We structured it using a seven-point Likert scale that asked to state their agreement with a given statement on a scale that ranged from "strongly agree" to "strongly disagree" with its midpoint anchored as "neither agree nor disagree". We positively worded most of the items but negatively worded a few. Prior to administering the survey instrument, we had experts in the context area review the survey to ensure that the adaptations used fit in the context. Subsequently, two well-established IS scholars with experience in survey research and expertise in the subject domain evaluated the instrument. After incorporating suggested changes, we administered the first phase of the pilot test to 70 executive MBA students in one of the top universities in Ghana who were actively using ERP systems in their organizations. Based on their feedback, we modified the instrument and tested it again using a similar approach with 30 managers from both manufacturing and service firms in the Ashanti Region of Ghana. We conducted telephone and email discussions with these managers to obtain clarifications and ensure that adjustments we made addressed their expressed concerns. We subjected data from the pilot study to confirmatory factor analysis (CFA) to gain insights as to the multidimensionality of the items using SmartPLS (Ringle, Wende, & Will, 2005). High loadings provide evidence for convergent validity. Since the research model has only positive relations, we reverse-coded negative worded items. The confirmatory factor analysis indicated acceptable factor loading on most of the hypothesized dimensions. We improved the instrument by removing, rephrasing, and adding some items to the affected constructs. With this strategy, we achieved adequate content validity of the measurement scales and could test their psychometric properties (i.e., scale reliability and construct validity). We then employed the revised instrument in the main survey.

4.2 Data Collection

All the constructs included in the research model (Appendix 1) tap into experiences or perceptions of the chief information officer (CIO) or the highest IT personnel of the organization that has implemented an ERP. The unit of analysis is the organization, and, thus, the CIO or the highest IT personnel in these organizations who use the systems were the most appropriate data source for this research.

An ERP consultant provided one of the authors with a list of all the organizations that have registered as ERP users. The list contained 250 firms from 13 industries that had implemented ERP systems (at least one module in Ghana. We sent letters to the CEOs of the 250 institutions that requested their firms to participate in the survey. One hundred and fifty out of the 250 institutions wrote back to express interest in the survey. We issued questionnaires to these firms. The questionnaires targeted the CIO or the highest IT personnel in these organizations. After about three follow-ups of reminders through telephone calls, we retrieved 130 responses (an initial response rate of 52 percent of identified firms). We discarded questionnaires with greater than 10 percent of responses missing as Hair et al. (2010) recommend. Accordingly, we discarded 10 questionnaires due to missing data, and an additional five were unusable. Thus, 115 useable responses remained (a 46% response rate).

We used several procedures to mitigate the effect of common method bias. Podsakoff, MacKenzie, Lee, and Podsakoff (2003) provide guidance to reduce common sources of this bias. The two key ones are to ensure anonymity in survey administration and to improve measurement items for the constructs. First, we maintained anonymity in the questionnaire and asked respondents to be as honest as possible while reassuring them that there is no right or wrong answer (Podsakoff et al., 2003). Second, the pilot test improved the scale items by removing vague concepts, ambiguous and unfamiliar terms, and double-barreled questions (Podsakoff et al., 2003). Also in measuring most of the study constructs, we relied on previously tested scales. According to Podsakoff et al. (2003), a well-tested and validated scale helps to reduce item ambiguity. Finally, we also counterbalanced the question order was to control for the priming effect and other item-context induced mood states (Podsakoff et al., 2003).

4.3 Measurement Model Validity

We used partial least squares (PLS) to analyze the data. PLS, also known as variance-based structural equation modeling (SEM), focuses on maximizing the variance of the dependent variables explained by the independent variables instead of reproducing the empirical covariance matrix (Hair, Hult, Ringle, & Sarstedt, 2014). According to Hair et al. (2014) and Joreskog and Wold (1982), PLS is generally recommended for predictive research models that focus on theory developing, while LISREL, a co-

variance based SEM, is recommended for confirmatory analysis and requires a more stringent adherence to distributional assumptions. We selected PLS based on our research purpose, research models, and data characteristics; in our case, we had an exploratory, complex model with both formative and reflective constructs and many indicators. Further, researchers suggest that using PLS requires a sample size of at least ten times the number of structural paths that connect at the endogenous variable with the most paths originating from exogenous variables (Barclay, Higgins, & Thompson, 1995; Chin, 1998). Since the endogenous variables had at the most three incoming paths, we needed a minimum sample of 30. Thus, given our sample size (115), we determined that we had enough observations to meet PLS requirements. Furthermore, we used Cohen's (1988) power table for multiple regression (MR) analysis to calculate power values for the PLS models. Since PLS is performed by iterative regression analysis (Chin, 1998), power analysis on MR is applicable for PLS. We employed the indicator approach to model the construct with the most incoming path, BPO, with 13 indicators, and then tested it with a conservative approach. The power for the sample size of 115 using a two-tail test was 0.80, which meets the minimum threshold that Cohen (1988) propose. We assessed the validity of the measurement model for formative and reflective constructs differently. For reflective constructs, we assessed the convergent validity, discriminant validity, and item and cross-loadings.

We performed factor analysis to explore the factor loading and cross-loading pattern for the items that comprised the reflective constructs of our study. We assessed convergent validity by measuring the reliability of survey items: composite reliability of constructs, average variance extracted (AVE), and factor loadings (Hair, Black, Anderson, & Tatham, 2010; Komiak & Benbasat, 2006). Initially, we observed some cross-loadings. We removed some of the reflective items that had inadequate loadings or had significant loadings across constructs (COR4, ORGI1, ORGI2, ORGI3, and ORGI4) from the analysis. All remaining items loaded on their own constructs, and cross-loadings were not significant across constructs. As Table 2 shows, the AVE values of all the constructs were higher than 0.5 as required (Barclay et al., 1995), and composite reliability values also exceeded the recommended 0.7 threshold (Chin, 1998). We assessed discriminant validity by comparing the square root of AVEs of constructs to the inter-correlation of constructs against other constructs (Fornell & Larcker, 1981).

Table 2. Psychometric Properties of the Research Constructs

Constructs	AVE	Composite reliability	R square
Business process outcomes	0.5046	0.9292	0.3287
Extent of ERP	-	-	0.3228
Corruption	0.7841	0.9159	0.7722
Data culture	0.8610	0.9611	-
Process effectiveness	0.6348	0.9121	0.9006
Process efficiency	0.6614	0.8542	0.6404
Process flexibility	0.6183	0.8660	0.7543
Organizational control	0.7666	0.9077	0.7509
Organizational integration	0.8659	0.9509	0.3715

Adequate discriminant validity exists when the square root of AVEs are bigger than inter-construct correlations. This condition was met. Thus, reflective constructs had adequate measurement model validity. We conceptualized the extent of ERP implementation construct with formative indicators. For formative indicators, we examined the item weights, which usually have smaller absolute values than item loadings as Diamantopoulos and Winklhofer (2001) recommend. The item weights values for the three formative constructs were 0.265, 0.435, and 0.425 with corresponding t-values of 2.272, 3.969, and 3.183 for functional scope, organizational scope, and geographic scope, respectively, which were all significant at the 0.01 level. The values indicate that the organizational scope and geographic scopes were the most important dimensions of the extent of ERP construct in the study's context. Following Hair et al., (2014), we conducted a multicollinearity test using the variance inflation factor (VIF). The VIF generated for the formative indicators of extent of ERP implementation construct revealed the highest VIF factor of 3.780. Hence, VIF values do not exceed the recommended threshold value of 5. Thus, we conclude that collinearity among the indicators did not reach critical levels for the formative construct and was not an issue for the estimation of the PLS path model.

5 Results

5.1 Demographic Data

We analyzed the data to identify the characteristics of the organizations that participated in the study. In all, 65 percent of the firms were solely Ghanaian owned, 28.7 percent were foreign owned, 4.4 percent were joint ventures, and 1.7 percent were "other". The majority (86%) of the firms in the study were private organizations, which suggests that private sector organizations are driving ERP implementation in Ghana. Analyzing the composition of the respondents by industry showed good representation among the core industries. Moreover, some respondents opted for "other" to describe their industry. Usually, such a need arises when respondents feel that the listed industry types do not adequately represent the nature of their firms or sector. "Financial services" was the most-predominant category, which could result from the rapid proliferation of financial service providers in the country: such organizations need integrated software systems to record, monitor, and coordinate in and across several branches all over the country.

5.2 Test of Hypotheses

We evaluated and examined the hypotheses developed from the research model based on the results obtained in the PLS analysis. We present the results in Table 3.

We found support for all six hypotheses. The influence of data culture on the extent of ERP implementation was significant (H1). Here, we found support for the argument that the extent to which organizations can implement ERP systems to enforce panoptic control depends on the existing IT foundation and the recognition that sound data-driven culture supports ERP implementation.

We also found support for the ability of ERP implementation to exert panoptic control on SSA firms as greater extent of ERP implementation resulted in greater ethical behavior (H2). The greater ethical behavior created by ERP implementation resulted in greater BPO (H4). The results reveal that several firms reported low levels of organizational corruption or higher levels of anti-corruption practices. We may explain this finding by the fact that ERP systems enforce organizational control and reduce organizational corruption through panopticism.

Table 3. Hypothesis Test of Survey Variables

Hypothesis	Path coefficient	t-value	Support
H1: Data culture → extent of ERP Implementation	0.568	19.344***	Supported
H2: Extent of ERP implementation → ethical behavior	0.643	25.426***	Supported
H3: Extent of ERP implementation → organizational integration	0.609	20.020***	Supported
H4: Ethical behavior → BPO	0.217	3.966***	Supported
H5: Organizational integration → BPO	0.117	2.609***	Supported
H6: Extent of ERP implementation → BPO	0.324	5.761***	Supported
***p < 0.01			

The results of the hypotheses that concern organizational integration with regards to ERP implementation revealed that greater extent of ERP implementation was associated with greater organizational integration (H3). Further,greater organizational integration was associated with greater business process level benefits (H5), a stance that several studies have supported (Barki et al. 2002; Koufteros et al. 2010). These findings point to an important role of organizational integration in ERP implementations in the SSA region. More importantly, note that all the three indicators in the organizational integration construct relate to functional integration, which means that ERP implementation demands the interdependency of the functional units. Finally, the effect of the extent of ERP Implementation on BPO was supported (H6). Figure 2 represents the results of path analysis.
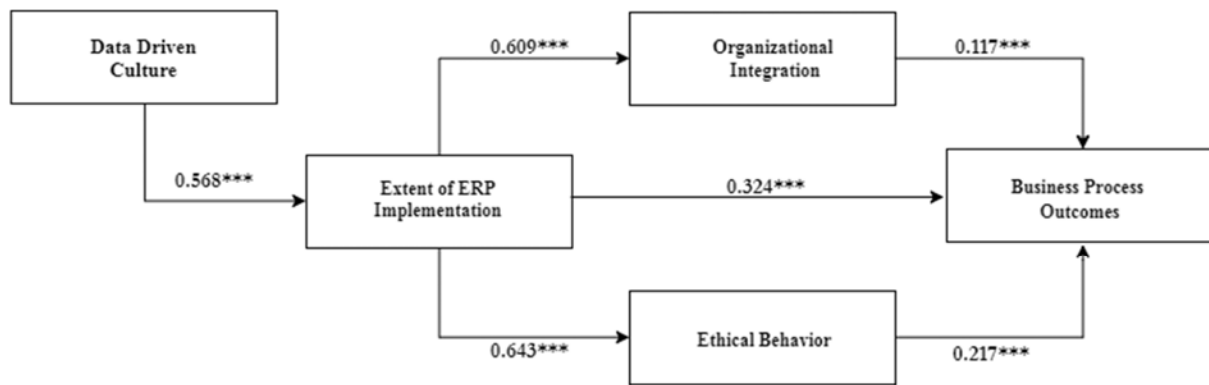
Note *p < 0.1; **p < 0.05; ***p < 0.01

Figure 2. Results of Path Analysis

6   Discussion and Conclusion

6.1   Discussion

From the panoptic perspective, we contend that, in the SSA context, an organization's data-driven culture serves as an antecedent to its ERP implementation, which, in turn, leads to greater organizational integration and ethical behavior—both of which lead to positive business process outcomes. We found that data-driven culture had a significant impact on the extent to which a firm implements ERP. Further, we found that the extent to which organizations can achieve panoptic control by varying their extent of ERP implementation depends on the existing data-driven culture. Our results support the hypothesized positive relationship between greater extent of ERP implementation and greater organizational integration, which affirms the results of several studies (Barki & Pinsonneault, 2005; Koufteros et al., 2010; Turkulainen, 2008). Our results also support the ability of ERP implementation to exert panoptic control on SSA firms because a greater extent of ERP implementation resulted in greater ethical behavior (low corruption and high organizational control).

Further, our findings support the hypothesis that greater ethical behavior (low corruption and high organizational control) positively affects the BPO obtained from ERP implementation. Contrary to the perception that firms in SSA are generally corrupt because of the reported high rates of corruption in the local and global media (Citifm, 2014; Daily Graphic, 2014; Ghana News Agency, 2014; Mordy 2013; Myjoyonline, 2013; Owusu, 2014), we found that several firms presented positive response for the corruption indicators, which indicates low levels of organizational corruption. These firms may have developed ethical, professional, and corporate socially responsible behaviors and cultures regarding operations and behavior in their institutions. Institutional forces and regulations from external bodies may account for this development. Some firms have institutionalized anti-corruption systems to ensure an efficient running and performance of their firms and so ERP systems can enhance ethical behavior of employees (Asamoah, 2014; Luo, 2005).

The paper contributes to theory and practice. For theory, the study demonstrates the importance of ethical behavior, organizational integration, and data-driven culture variables in understanding ERP implementation in the SSA context. Further, by examining the modified model in a different environment, the study strengthens theory on ERP benefits (Bagchi, 2007; Dennis & Valacich, 2014; Kouki et al., 2009; Tsang & Kwan, 1999). Understanding the impact of ERP systems in developing nations and, more importantly, the SSA region should be of interest to both practitioners and academics because it presents a new and significantly different context to most existing studies (Roztocki & Weistroffer, 2011). We need more studies that explore the specific case of ERP implementation in SSA countries to expand our understanding and improve the success of ERP implementations in the subregion. We present a model that researchers can test in in other contexts. Our application of the panoptic perspective helps explain how ERP systems afford organizations the ability to control employee activities and enforce appropriate ethical behaviors. The panoptic perspective has emerged as a new and interesting view to explaining and

predicting acceptance and success of ERP implementations in SSA. This perspective can serve as a new alternative and/or complement regularly used theories such as resource-based view of the firm theory. The study's model could be applicable to regions beyond SSA because one can replicate the panoptic organizational control that ERPs create in SSA firms in other environments.

For practitioners, the study suggests that organizations can benefit from a wider extent of ERP implementation because such endeavors provide a mechanism that causes employees to be mindful of expected ethical behavior when using ERP or integrated systems; actions that lead to positive business process outcomes and subsequent organizational performance. An organization's data-driven culture drives the need for the firm to more significantly implement ERP, which engenders greater ethical behavior, greater organizational integration, and positive business process outcomes. Managers of firms in the SSA region must adopt the data-driven culture. Organizations, their owners, managers, employees, and government institutions can and must place high value on data as a strategic asset in their operations and decision making. For these organizations to become data-driven, they should first put in place integrated systems such as ERP, which will assist the managers to, among other things, analyze past data trends to predict future growth patterns—all in a bid to use data as the basis for decision making. The adoption of the culture of effective data-driven decision making among indigenous SSA businesses will not only minimize the barrier to ERP implementation, acceptance, and usage in SSA but will also cause the latter to compete favorably with organizations in developed nations (Asamoah, 2014; McAfee & Brynjolfsson, 2012). A mitigating external factor to the widespread adoption and use of ERP systems in SSA is the lack of vital government support for ERP adoption and use. Research has noted that governments can play a major role in propelling widespread ERP adoption and use by initiating and enforcing policies that promote ERP usage (Abdelghaffar & AbdelAzim, 2010; Huang & Palvia, 2001). To do so, they can require and enforce the timely collection of vital organizational data such as tax information and financial records and employee social welfare of public and large private institutions. Governments can also set mandatory data and information standards and protocols for specific industries. Governments also have responsibility to improve the IS and energy infrastructure needed to support ERP adoption; these factors also support ICT adoption in general (Bagchi et al., 2007). Government or industry regulators can require the major players in industries such as banking, oil and gas, mining, and telecommunications to implement IS before they receive the requisite operational licenses. Such policies will help regulatory organizations in their duties and invariably improve the data culture in the SSA region and, thus, facilitate the industry-wide standardization of best practices in-built into ERP systems. As a result, local SSA business will operate more efficiently and perform better.

6.2   Conclusion

Existing literature suggests that business environment has influence on the successful adoption and use of IT (Chou & Chang, 2008; Soh & Sia, 2004), and researchers have identified the social and economic context of developing countries as a primary factor in ERP assimilation (Kouki et al., 2009). We present a theoretical model that examines the antecedent and outcomes of the extent of ERP implementation in SSA. We conducted this research with data that we collected from Ghana, a SSA nation. We identified data-driven culture as the antecedent (Asamoah, 2015). Further, the extent of ERP implementation influenced organizational integration, ethical behavior, and BPO.

The study has several limitations. First, we focused only on Ghana. Future research may extend the current work by collecting data from other SSA countries to enhance the generalizability of the findings and the research model that we present in this paper. Although we contacted all the ERP users in the user group, some users may not have been members of the user group registered and, thus, did not feature in our study, which affects the generalization of the findings. Future research could examine how institutional forces influence organizations' data culture, ethical behavior, and/or extent of ERP implementations in the SSA region. In addition, there might be differences in the results between private and public organizations. However, since only 14 percent of the organizations in our study were public ones, we could not analyze the differences. Hence, future research could consider a sample with larger percentage of public institutions. In this way, analyzing the differences between private and public institutions could provide new insights into antecedents and impacts of extent of ERP implementation in the Sub-Saharan Africa region.

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Appendix

Table A1. Measurement Constructs, Items, and Source

Construct	Item code		Items	Reference
Extent of ERP implementation (ERPEX)	ESC1	Formative 1st order	Functional scope of implementation of your selected ERP (select all that apply): accounting/finance, manufacturing, planning/scheduling, human resources, sales/distribution, logistics/inventory control, other (please specify):	Karimi et al. (2007)
	ESC2	Formative 1st order	Organizational scope of implementation of your selected ERP: department, division, Entire company, multiple companies, other:	
	ESC3	Formative 1st order	Geographical extent of implementation: single site, multiple sites, national, Worldwide	
Business process outcome (BPO) / process efficiency (EFCO)	EFCO1	Reflective 1st order	ERP implementation has improved the efficiency of our operations	Karimi et al. (2007)
	EFCO2	Reflective 1st order	ERP implementation has lowered our cost of operations	
	EFCO3	Reflective 1st order	ERP implementation has reduced the amount of rework needed for data entry errors	
Business process outcome (BPO) / process effectiveness (EFTO)	EFTO1	Reflective 1st order	Data provided by ERP add value to our operations	Karimi et al. (2007)
	EFTO2	Reflective 1st order	ERP implementation has improved timely access to corporate data	
	EFTO3	Reflective 1st order	The ERP system provides a high level of enterprise wide data integration	
	EFTO4	Reflective 1st order	ERP implementation helps us make better revenue forecasts than before	
	EFTO5	Reflective 1st order	The functionalities of ERP adequately meet the requirements of our jobs	
	EFTO6	Reflective 1st order	ERP implementation has improved our quality of operations	
Business process outcome (BPO) / process flexibility (FLXO)	FLXO1	Reflective 1st order	ERP implementation has given us more ways to customize our processes	Karimi et al. (2007)
	FLXO1	Reflective 1st order	ERP implementation has made our company more agile	
	FLXO1	Reflective 1st order	ERP implementation has made us more adaptive to changing business environment	
	FLXO4	Reflective 1st order	ERP implementation has improved the flexibility of our operations	
Ethical factors (ETH) / corruption	COR1	Reflective 1st order	There are clear systems in place to prevent management from abusing their position for personal interests	New
	COR2	Reflective 1st order	There are clear systems in place to check employees who go against organizational and professional ethics	
	COR3	Reflective 1st order	Our organization has implemented effective anti-corruption initiatives	
	COR4	Reflective 1st order	Our organization is free from excessive bureaucratic regulations and controls	
	COR5	Reflective 1st order	Information that can expose our organization to scrutiny by government institutions is not recorded	

Table A1. Measurement Constructs, Items, and Source

Ethical factors (ETH) / Organizational control	ORGC1	Reflective 1st order	Our firm does not allow government institutions to have access to operational data	New
	ORGC2	Reflective 1st order	External stakeholders' activities that may improve organizational control interfere with the firm's operations	
	ORGC3	Reflective 1st order	Important operational information is often withheld by top managers and owners	
	ORGC4	Reflective 1st order	External stakeholders influence control of our organization	
Organizational integration (ORGI)	ORGI1	Reflective 1st order	There is generally a high level of inter-departmental communication in our organization	New
	ORGI2	Reflective 1st order	Departments prioritize their own success over the organization's success	
	ORGI3	Reflective 1st order	Unclear roles, goals, or leadership cause uncertainty in our firm	
	ORGI4	Reflective 1st order	Departments in our organization are dependent on each other	
	ORGI5	Reflective 1st order	ERP implementation has resulted in greater coordination among the functional areas	
	ORGI6	Reflective 1st order	Inter-departmental interaction has increased as a result of ERP implementation	
	ORGI7	Reflective 1st order	Problems between functional areas are easily resolved after the ERP implementation	
Data culture (DDD)	DDD1	Reflective 1st order	Our organization has the data it needs to make decisions	Brynjolfsson et al. (2011)
	DDD2	Reflective 1st order	Our organization depends on data to support its decision making (the work practices and environment of the entire company)	
	DDD3	Reflective 1st order	Our organization spends significant time analyzing data to support decision making	
	DDD4	Reflective 1st order	Our organization uses data rather than guess work to make decision	

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