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Exogenous and Endogenous Factors in E-procurement Adoption among Ghanaian Hospitals : A Co-Integration Analysis

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ABSTRACT

Amidst all of the uncertainty surrounding the future of healthcare service efficiency in Ghana, the need for providers to do more things with less resources is widely considered a truism. Aware of the relative weight and significance of the supply chain, many hospitals in Ghana have initiated measures to fully adopt technology towards the performance of key healthcare activities. Using data collected from selected public hospitals in the Ashanti Region of Ghana, we recalibrate and classify the influential or stimulating factors of e-procurement adoption into exogenous and endogenous variables to determine the most influential factor. We employ a more sophisticated co-integration approach in order to observe robustness of outcome relative to the extant models. We observed that e-procurement optimization is premised on the prevalence of an ensemble of exogenous and endogenous factors including resources availability, facilitating conditions, system interoperability, supplier compatibility, regulatory framework, operational standards and benchmarks and other external/industry factors.

Keywords: E-procurement, CPO, PPM, VECM, LNRa

I. INTRODUCTION

Health care represents a significant portion of today's service economy and there is much that has yet to be done to transfer the lessons learned from years of studying the manufacturing sector (Ballou-Aares, et al. 2009). As more and more research is published in this field, it is beginning to show that not only does health care operations benefit from the lessons learned in manufacturing, but unique findings in health care supply chain research are emerging that can also benefit the traditional manufacturing sector supply chain (Ballou-Aares, et al. 2009). Amidst all of the uncertainty surrounding the future of healthcare in Ghana, the need for providers to do more things with fewer resources is widely considered a truism.

Similarly, looming cuts from government payers and increased scrutiny from private payers, employers and patients alike have forced many healthcare service providers to reconsider previous strategies as they embrace new levels of efficiency and effectiveness going forward (Blecker and Abdelkafi, 2006). This is because, after labor, supply chain typically represents the second highest operating expense ranging from one-third to one-half of the entire operating budget for the hospitals Blecker and Abdelkafi, 2006). Evidence from the public accounts committee on health services in the parliament of Ghana has noted that most healthcare facilities have not given supply chain initiatives commensurate attention and hence face severe but avoidable financial consequences accordingly (Afriyie, 2014).

In Ghana, health care is ubiquitous with emotionally and politically charged debate regarding its design and accessibility to the public at large, yet one point that most people agree on is that there exists much potential for improving the efficiency and effectiveness of health care delivery (Agyepong, et al, 2016). A historic overview of the operation of Ghana's hospitals shows expansion of top-line revenue has blinded many of the administrators to bottom-line results that can be fostered through improved business processes. In addition to

cost, improved safety and outcomes resulting from standardization create a "burning platform for elevating the contribution of efficient and effective supply chain management" (Blecker and Abdelkafi, 2006).

Aware of the relative weight and significance of the supply chain, many hospitals in Ghana have insulated initiated measures to fully adopt technology towards the performance of key healthcare activities including Komfo Anokye Teaching Hospital, Korlebu Teaching Hospital, University of Ghana Teaching Hospital, Cape Coast Teaching Hospital, Tamale Teaching Hospital etc (Asante Antwi, 2014) Yet one the application of technology to supply chain function is far from attainment under the healthcare information system. One major area of technology application to supply chain that has suffered significant setback despite its importance is e-procurement in the healthcare sector. Generally, an enterprise chief procurement officer (CPO) or procurement department usually sets the policies governing procurement of materials within an organization, with the goal of acquiring a product or service of the greatest value at the best possible price at the time it is needed (Arhin, 2015).

To meet this goal, procurement leaders negotiate contracts, establish relationships with suppliers and set guidelines or limits on what spending can take place for which items. E-procurement software allows procurement leaders to automate adherence to these policies, contracts and vendor relationships within the system (Yiranbon, 2015). The extant literature provides ample evidence of failed adoptions as well as the weak adoption of e-procurement in healthcare settings in many parts of the world with contradicting reasons. For example, some researchers have looked at the lag in e-procurement adoption from the technology adoption model perspective in which perceived usefulness and perceived ease of use are used as predicting factors (Arhinful, 2013).

Moreso, a strand of literature have examined e-procurement from the perspective innovation diffusion. Rogers contend that the process of diffusion and acceptance of an innovation such as e-procurement in a healthcare sector is not a one-off event but rather goes through a five-step decision-making process that occurs through the defined channel of communication which, according to him are the five main stages or steps through which people get to know and use technology and other innovation (Arhinful, 2013).

These are the awareness of the technology; development of interest in the technology, testing the technology, evaluating the technology and finally the adopting the technology as an integral part of one's working life. Verhoeven et al (2010) contend that the adoption process of institutions such as hospitals is similar to that of the individual since institutions are generally made up of people who exhibit the above-mentioned characteristics. Based on the above analysis, Bagozzi et al (2002) have explained that usually individuals can reject the technology at any time within the adoption process or afterward. Despite the importance of this approach and process of technology adoption, Abrahamson (1991) has criticized this five stage process of adoption by arguing that it assumes that even technically inefficient and technically efficient innovations diffuse in the same way. He further argues that on the contrary, there are impediments which affect the rate of diffusion leading to a change of a comprehensive evaluation of the process of innovation diffusion in subsequent works of Rogers.

In the latter works, he claims that innovation is diffused through knowledge acquisition as opposed to mere awareness, persuasion as opposed to interest and then finally the user decides to use the innovation or technology (Bagozzi, 2007). Based on this, the users or institutions, then move to actual the implementation or use of innovation and this is subsequently confirmed by the continuous use of the technology platform. Thus even Rogers' relative advantage, compatibility, complexity or simplicity, trialability and Observability configuration of technology adoption to e-procurement as well as Venkatesh's unified theory of technology adoption have still not provided the needed clarity on the factors influencing or stimulating e-procurement adoption among institutions such as hospitals.

Yet a critical review of the factors militating against this deployment brings out both organization-wide factors (endogenous) as well as external environmental factors (exogenous). Our study departs from this approach by recalibrating and classifying the influential or stimulating factors of e-procurement adoption in Ghanaian hospitals into exogenous and endogenous variables to determine the sources of the most influential factor. Moreover, we depart from basic

regression analysis which is the dominant test technique in most of the current literature and opt for a more sophisticated co-integration approach in order to observe robustness of outcome. This article looks at the role of supply chain management in the health care industry (Andrews, et al. 2010). This topic is particularly relevant to the supply chain management community given the continual shift from a manufacturing economy to a service economy among developing nations. After outlining the aim and objectives of the research, we organize the remaining sections by looking at related literature before explaining out data and data collection process. We then outline then an ensemble of analytical co-integration models and parameters for our study. We conclude the research by explaining our findings and proposing future research direction.

Related Works

According to Anderson (2015), the adoption of e-procurement strategies in particular and technology based supply chain management practice is part of the process of value chain creation. Porter‘s (1985) value chain model has long been accepted as a meaningful explanation of a firm‘s competitive advantage owing to its identification of cost drivers and sources of differentiation. The value chain concept describes the primary and secondary activities of a firm necessary to create margin and in doing so provides direction on those activities which may be outsourced or retained the firm to pursue exactly what is required: inbound materials, raw materials inventories (both considered inbound logistics by Porter), manufacturing (called operations by Porter), finished goods inventories, and distribution within a single organization (considered outbound logistics by Porter), (Gehmlich, 2008).

Herein, primary activities include patient admission (representing inbound logistics), diagnosis and treatment (representing operations), patient discharge (representing outbound logistics), hospital marketing (representing marketing and sales), and health checkups (representing follow up service). The secondary or supporting activities are shown as hospital infrastructure (representing firm infrastructure), hospital staff (representing human resource management), research and development (representing technological development), and medical supplies (representing procurement) (Gehmlich, 2008). According to Porter (1985), a firm manages these activities in a unique way to create margin in the space between it and the patient, placing the customer on the outside of the value creation process (Prahalad and Ramaswamy, 2004).

The supply chain then can be viewed as a linear collection of value chains. According to this perspective, every company occupies a position in the supply chain with upstream suppliers providing value in their inputs prior to sending them downstream to the focal firm where it then performs a process comprised of a collection of the primary and secondary activities described earlier to add value before sending the product or service downstream again to the next actor or end consumer (Normann and Ramirez, 1993). An example of this approach in a healthcare context might be a primary care physician who examines and diagnosis an elderly patient with severe Bronchitis prior to referring the patient for hospital admission. The hospital then coordinates treatment and discharges the patient home and involves home care.

Some scholars believe that this paradigm has become outdated (e.g., Normann and Ramirez, 1993). Instead, today many believe that competition and consequently value creation centers on personalized interactions between customers, the focal firm‘s employees, and other supply chain actors (Prahalad and Ramaswamy, 2004)). As such, the customer is no longer placed outside of the value chain but instead, can participate in a myriad of value creation activities throughout the entire supply chain or network. In this way, the customer‘s role transitions from that of a consumer of value to a creator of value. These value coproduction activities are very similar to those discussed in Porter‘s (1985) value chain and include co-development of new products and services, production, assembly, distribution, use, and after sale service (Zhang and Chen, 2008).

As was the case with Porter‘s (1985) value chain, these activities have relevance in a healthcare setting as co-development of new services represents (technological) development, diagnosis and treatment represent production and assembly, patient discharge represents a distribution, and health checkups represents use and after sales service.

This movement toward value co-creation has caused firms to realize that they do not simply add value in a discrete process stage, but instead they partner with customers/patients, suppliers, and other business

partners to repeatedly reinvent it (Normann and Ramirez, 1993). As such, the focus of these firms has shifted from the product/service itself to the value creation system which comprises these actors. The continual quest to improve the fit between the composition and competencies of the value creation system and the customer has emerged as a primary goal centering attention on the reconfiguration of roles and relationships among this constellation of actors in order to mobilize the creation of value in new forms and by new players. Ford and Scanlon (2007) present a network approach describing the healthcare supply chain that well represents such a constellation or value creation system as described by Normann and Ramirez (1993).

Value co-creation, therefore, provides a useful theoretical perspective in grounding the understanding of supply chain practices in healthcare. Its focus on connecting the key actors involved in value creation regardless of their specific role is highly applicable in healthcare as the demarcations defining the role of each actor in the primary care delivery supply chain are far more blurry than in other industry sectors. Schneller and Smeltzer (2006) discuss this issue as the mix of external and internal clients.

Healthcare Supply Chain

Traditionally, supply chain management has been tasked with providing the right product, to the right customer, at the right time and for the right price (deemed "perfect order" by supply chain professionals) (Odaffer 2010). Functionally, this usually involves managing the acquisition, storage, distribution and replenishment of materials and supplies. The future of the supply chain, however, will increasingly focus on being "demand driven" (Odaffer 2010). Functionally, this implies a strategic focus on leveraging people, technology and information to manage four key areas or "macro processes": Customer Relationship Management (physicians, nurses, departments, etc.), Internal Supply Management or ISM (inventory replenishment/holding strategy), Supplier Relationship Management or SRM (medical device manufacturers and other supply companies) and Purchasing Partner Management or PPM (group purchasing organizations, distributors, etc (Barnes, 2015).

Regardless of strategy, every supply chain department is responsible (directly or indirectly) for the sourcing, contracting, purchasing, external distribution (from supplier or distributor), receiving, storage, internal distribution and replenishment/disposal of medical supplies and equipment. The literature survey and field research indicate that most providers carve out pharmaceutical supplies as a separate department/function, although some progressive organizations have moved closer towards integration (Thompson, 2015).

Additionally, many providers also assign oversight of purchased services (mail, print shop, laundry, etc.) to the supply chain department as well as responsibility for sterilization and account payable (Kowalski 2011). It should be noted that several key characteristics impact process flows for a given provider organization including setting/type (acute care vs. post-acute, general medical/surgical vs. specialty hospital, etc.), employment of technology and level of outsourcing vs. insourcing.

McKone-Sweet et al (2005) highlight the challenges in translating traditional supply chain concepts to healthcare: namely the pace of technological change and the inability to generate accurate forecasts. Work (2010) explains a case study that points to the successful results that can be obtained with the implementation of information technology systems in the health care arena. Li and Benton (2006) explore the important role that technological investments and nursing development and training have on hospital performance from both a quality and cost perspective. The authors cite anecdotal evidence that casts concern on the assumption that technological investment is always appropriate.

Bhattacherjee et al. (2007) shed some light on the technology paradox by suggesting and empirically confirming that different types of technological investments have varying impacts on the level of performance enhancement achieved. Kowalski (2009) advocates for a cross-functional coordination of supply chain strategy and planning within healthcare supply chains. In the Shah et al (2009) paper, one observes the concepts of lean applied to the improvement of a health care supply chain and how the use of relational governance can be leveraged to achieve superior performance in a supply chain that is not governed by financial or contractual mechanisms.

Barlow (2009) discusses the importance of aligning the supply chain and finance organizations in the cadence of the revenue cycle. Sinha and Kohnke (2009) present

three different macro perspective frameworks that can be used to study how health care supply chains operate to match supply and demand. Ross and Jayaraman (2009) present a health care purchasing-focused study of hospitals that procure bundled offerings that include remanufactured medical devices and equipment. Their article offers an analytical model that helps buyers and managers analyze the tradeoffs that exist in such a scenario

E-procurement in Supply Chain

In supply chain management, e-procurement can be particularly beneficial for procuring indirect materials (i.e., those items and services that are not directly involved in producing whatever final product is sold by the organization) (Johnson, 2015). This category of goods typically includes office supplies, janitorial and facilities supplies, and other lower-cost items. E-procurement may not work well for every type of purchase, however. One such area, for example, is the procurement of mission-critical items that are available through only a few suppliers; where inventories can run low; where procuring them involves complex negotiations, and/or where the potential to lower costs through an e-procurement platform is minimal (Johnson, 2015).

In the supply chain, E-procurement is facilitated by e-procurement software. Although available functions and features vary from vendor to vendor, e-procurement software typically computerizes numerous procurement-related activities -thereby eliminating the need for manual and/or paper-based processes (Vondrembse, et al, 2006). One key feature of e-procurement software is that it allows employees to search through online catalogs as well as select and acquire needed items online. However, e-procurement and the software that supports it enable far more than merely an online shopping experience (Sivadasan, et al, 2002). More specifically, e-procurement automates many of the functions, procedures, and policies that an organization uses to manage its procurement process.

E-procurement applications allow employees to manage their own purchases, from the selection of the desired items from within a preprogrammed offering that matches the procurement office's parameters for cost and quality and supplier; to submitting requisitions; to tracking delivery status (Johnson and Johnson, 2014). This automation streamlines the procurement process and makes it more efficient, thereby making it faster and less costly. It also removes low-value tasks from the procurement department, which can then redirect its resources to higher-value activities such as negotiating contracts. Furthermore, the tools within many e-procurement applications allow procurement leaders to customize the procurement experience, determine which items will be available through e-procurement to which users. Many platforms also offer access over smart phones and tablets (Barnes, 2014).

Similar to the implementation of other electronic systems, implementing an e-procurement application comes with potential challenges, particularly around installing and integrating the software with other enterprise back-end systems; training employees to use it; and working with suppliers to ensure a smooth transition to the new computer system (Barnes, 2013). E-procurement can produce significant benefits for the organizations that implement it. It can lower transactional costs, increase the visibility of enterprise procurement spending, and deliver better reporting of procurement trends and metrics through automation (Zhang and Chen, 2008). It can also limit or eliminate so-called maverick spending, which happens when employees procure products "off contract," in other words, purchases outside the parameters set in contracts negotiated by the procurement office and suppliers (Barnes, 2016).

II. METHODS AND MATERIAL

Data

Purposively, the medical superintendents, procurement officers, pharmacists, store managers and contract administrators of the four government hospitals were considered in the investigation for data collection. The hospitals were Komfo Anokye Teaching Hospital, Tafo Government Hospital, Suntreso Government Hospital and Manhyia Government Hospital. Those professionals were considered as the research population because they are involved in the entity tender committee of the supply chain management and have much experience in the current procurement practices of the government hospitals.

The total population of these respondents is twenty (20). Five (5) persons were contacted from each hospital. An

authentic data was therefore obtained from a census sampling that amounts to twenty (20) which was analyzed for a reliable outcome. Data was collected by administering a closed-ended questionnaire that was self-administered by the respondents at scheduled times. Since the activities and information of the SCMUs are always confidential as one of the procurement ethics and as a right to privacy (especially to suppliers), formal registrations were made at the government hospitals under study before permissions were granted for the ultimate survey at their various departments and units. Data was therefore collected as part of the answers provided to the questionnaires and literature review was conducted to support the following purposes.

Analytical Model

The empirical framework draws from the recent literature on the impact of endogenous and exogenous stimulating factors on e-procurement adoption such as (Kennedy, 1998). In line with this literature the general specification of the e-procurement adoption equation is given in equation (4.1):

$$Y=\phi_0 + \phi_1 Sv_{it} + \phi_n U_{nit} + \xi \ldots\ldots\ldots (1)$$

Where: Y is e-procurement adoption; Sv is endogenous and exogenous stimulating variables; X_n is a conditioning information set. Sv represents the primary variables of interest in this study. It comprises a measure of e-procurement adoption stimulating factors which are included in the empirical equation to measure the impact of endogenous and exogenous variables on e-procurement adoption. This is a dummy variable for stimulating factors (SvDUMMY). In line with the e-procurement literature, the control variables divided into endogenous and exogenous variables. The endogenous variables are the organization-wide factors and includes resource availability which is subdivided into three categories (financial resources (C1), technology (C2), skilled manpower (C3), facilitating conditions which is subdivided into six categories (national culture (C4), employee motivation(C5), organizational structure(C6), organisational culture(C7), related and support systems or system interoperability (C8), management support (C9). The exogenous variables include supplier compatibility (C10), regulatory framework which is subdivided into two categories (legal framework (C11), operational standards and benchmarks (C12) and other external/industry pressure (C13). Based on the above discussion we will estimate the equation as follows:

$$LNY=\beta_1 + \beta_2 + \beta_2 LNSvDUMMY\ (LNRa + LNFc + LNSc + LNrf) + \xi \ldots\ldots\ldots (2)$$

Where: Y is e-procurement adoption; SvDUMMY is dummy variable for stimulating factors and ε and ξ are the stochastic error terms. LN refers to natural logarithm. The stationarity properties of the time series variables are examined using the Augmented Dickey-fuller (ADF) approach. This is done to avoid spurious regressions if the variables in ordinary regressions are non-stationary. If the data series are non-stationary at levels i.e. I(0), it will be differenced d times to be stationary to determine its order of integration. Co-integration test involves two steps which include testing for unit root and the likelihood ratio test. Based on the unit root results in Table1, all variables with the exception of e-procurement adoption (Y) which is stationary at levels, are co-integrated of the same order, I(1). Since the time series variables are co-integrated of the same order, namely I (1), then the long run combination amongst the non-stationary variables can be established. We draw on Johansen and Juselius (1990) maximum likelihood (ML) procedure to test for the number of co-integrating vectors which also allows inferences on parameter restriction.

The hypothesis is H0 = Πq = αβ! where α and β! are n x r loading matrices and Eigen vectors. The aim of this procedure is to test the number of r co-integrating vectors β1, β2 …..βr which provide r stationary linear combinations of β! Xt-q. The linear likelihood ratio (LR) statistics for testing hypothesis H0 = Πq = αβ! is a test that there are at most r co-integrating vectors.

Unit Root Analysis

Once a co-integrating relationship has been established, the next step is to estimate the error correction model. We choose VECM, a full information maximum likelihood estimation model since it yields more efficient estimators of the co-integrating vectors ahead of other models which could have been used. VECM permits testing for co-integration in a whole system of equation in one step without requiring a specific variable to be normalized. Another advantage of VECM is the non-requirement for a prior assumption of endogeneity or endogeneity of the variables. In addition, VECM allows us to examine the causality in Granger-sense. The error correction term is evaluated using t-test

whilst the lagged first-differenced term of each variable uses the F-test.

In this part, we examine the effect that exogenous and endogenous variables have on e-procurement adoption by using modern time series econometric analysis over the collected data. The study undertakes modern econometric models including unit root testing, cointegration and Vector Error Correction (VECM) for empirical analysis. Both the short-run and long-run effects of stimulating variables were studied.

Table 1 Results of Augmented Dickey-Fuller test

Variable	ADF at Levels	ADF at(first difference)
LnY	(-6.614721) -4.234972* -3.202445** [0.0000]	
LNRa	(-2.773959) -4.243644* -3.544284** [0.2157]	(-4.296758) -4.252879* -3.548490** [0.0090]
LNFc	(-2.491342) -4.234972* -3.540328** [0.3302]	(-6.260091) -4.243644* -3.544284** [0.0000]
LNSc	(-0.446522) -4.243644* -3.544284** [0.9815]	(-9.363505) -4.243644* -3.544284** [0.0000]
LNrf	(-1.625667) -4.234972*	(-5.887478) -4.243644*
	-3.540328**	-3.544284**
	[0.7627]	[0.0001]

Note : ** denotes critical value at 1% confidence levels. **denotes critical value at 5% confidence levels ADF test statistics. MacKinnon (1996) one-sided p-value*

Table 1 presents the results of ADF unit root tests. The ADF test classifies all the selected variables with the exception of e-procurement adoption as I (1) that is, these variables are non-stationary at levels but are stationary after first differencing. E-procurement adoption status is, however, stationary at levels.

III. RESULTS AND DISCUSSION

Cointegration Test Results

Table 2 and 3 reports the results of the co-integration test. The results as shown below give conflicting reports. The trace test (table 2) results indicate that at least two cointegration equations at 5% levels exit. This test suggests two major contentions. First, the selected variables move along together in the long run and short terms deviations will be corrected towards equilibrium. Secondly, co-integration literally indicates causality in at least one direction. The Rank Test (Maximum Eigenvalue: Table 4.3) on the other hand indicates no co-integration at the 5% level.

Since the two test results could not agree on the existence or non-existence of co- integration among the selected variables, we fall on the VECM results to confirm the existence or otherwise of cointegration among the variables. The confirmation of the existence of co-integration will depend on the sign of the error correction term and its significance. When the sign of the error correction term is negative and significant at 5%, then the time series data are co-integrated of the first order I(1). On the other hand, if the sign of the error correction term is positive, we conclude that the data series are not cointegrated irrespective of the level of significance.

Table 2 Unrestricted Cointegration Rank Test (Trace)

Hypothesized		Trace	0.05	
No. of CE(s)	Eigenvalue	Statistic	Critical Value	Prob.**
None *	0.467019	71.67651	69.81889	0.0353
At most 1 *	0.445158	49.65210	47.85613	0.0336
At most 2	0.355677	29.03461	29.79707	0.0610
At most 3	0.301321	13.65016	15.49471	0.0931

At most 4	0.030951	1.100418	3.841466	0.2942
Trace test indicates 2 co-integrating eqn(s) at the 0.05 level				
* denotes rejection of the hypothesis at the 0.05 level				
**MacKinnon-Haug-Michelis (1999) p-values				

Table 3 Unrestricted Cointegration Rank Test (Maximum Eigenvalue)

Hypothesized		Trace	0.05	
No. of CE(s)	Eigenvalue	Statistic	Critical Value	Prob.**
None	0.467019		33.87687	0.6058
At most 1	0.445158	20.61749	27.58434	0.3000
At most 2	0.355677	15.38445	21.13162	0.2629
At most 3	0.301321	12.54974	14.26460	0.0917
None	0.467019	22.02441	33.87687	0.6058
At most 4	0.030951	1.100418	3.841466	0.2942
Trace test indicates 2 co-integrating eqn(s) at the 0.05 level				
* denotes rejection of the hypothesis at the 0.05 level				
**MacKinnon-Haug-Michelis (1999) p-values				

Analysis of Short-Run Relationship

The first differenced results presented in table 4 shows the short-term relationship among the selected variables and e-procurement adoption status. For example, it is observed that regulatory framework (LNrf), which is an important variable of interest, has a positive short-run relationship with E-procurement adoption status at both one period and two-period lags. But our analysis is basically on one-period lag variables of the annual series. At this period lag, a 10% increase or further removal of restrictions (enhancement) on the regulatory framework (LNrf) in Ghana will lead to a corresponding increase in E-procurement adoption status by approximately 17% in the short-run. Also, the one-period lag variable of Resource Availability (**LNRa)** has a positive short-run relationship with E-procurement adoption status in Ghanaian hospitals. All the other variables in the model have a negative short-run relationship with E-procurement adoption status. In the short run, a 10% increase in supplier compliance (LNSc) leads to an increase of approximately 9% in the E-procurement adoption status in Ghanaian hospitals. The other variables at one period lags were not statistically significant. The efficiency of the models was tested and found to be robust.

Table 4 Unrestricted Cointegrating Coefficients (normalized by b'*S11*b=I)

LNYT2	LNRa	LNSc	LNFc	LNrf
-2.288761	3.495727	-1.124827	-6.043735	2.385763
-1.101991	-0.903564	-0.379128	3.814696	-2.931498
0.716661	1.289760	0.976827	-0.329543	-3.721355
-0.395100	-5.986517	-0.108717	5.826516	0.979315
0.759476	-0.812824	-1.191202	-0.673434	0.934838

Analysis of Long-Run Relationship

The results presented in table 5 below shows the degree of long-run association among the individually selected variables C1-C13. This is evidenced by the value of (C1-C13) which represents the error correction term in the VECM. For there to be a long-run relationship, the value of C1-C13) must be negative and its P-value must also be significant at 5% levels. From table 5, the value of C1 is -0.601135 and its P-value is 0.0029, at 5% level of significance. The other relationships are expressed accordingly in the table. Thus, the variables in the model move together in the long-run, meaning also that in the long-run, the independent variables have an impact on e-procurement adoption status in Ghanaian hospitals (dependent variable).

Table 5 VECM results (Long run relationship)

	Coefficient	Std. Error	t-Statistic	Prob.
C(1)	-0.601135	0.179388	-3.351038	0.0029
C(2)	-0.426987	0.194313	-2.197417	0.0388
C(3)	-0.148411	0.171432	-0.865715	0.3960
C(4)	1.033716	0.635580	1.626413	0.1181
C(5)	-0.312279	0.816854	-0.382295	0.7059
C(6)	-0.892315	0.400829	-2.226172	0.0366
C(7)	-0.840672	0.285206	-2.947589	0.0074
C(8)	-0.730163	0.746392	-0.978258	0.3386
C(9)	-0.449818	0.703492	-0.639407	0.5292
C(10)	1.693080	0.788401	2.147485	0.0430
C(11)	1.700804	0.771548	2.204405	0.0383
C(12)	-0.036738	0.114930	-0.319653	0.7522
C(13)	-0.892315	0.400829	-2.226172	0.0366
R-squared	0.653806	Mean dependent var		0.041765
Adjusted R-squared	0.480710	S.D. dependent var		0.862840
S.E. of regression	0.621778	Akaike info criterion		2.158098
Sum squared resid	8.505379	Schwarz criterion		2.696813
Log likelihood	-24.68766	Durbin-Watson stat		1.833436

IV. CONCLUSION

The objective of the research was to explore the stimulants to e-procurement adoption among the Ghanaian hospitals based on data collected from the cross section of hospitals in the Ashanti Region of Ghana. It was stated by Thompson et al (2014) that despite the importance of adoption and the government efforts in pushing the use of ICT in business, the adoption rate of e-Procurement in Ghana is low. This may be because of the understanding of the drivers of e-Procurement adoption as well as perceived impediments, and how these vary between firms and between activities, is lacking.

Prior studies have argued that several influential factors dictate the pace of e-procurement adoption as an integrated part of modern technology based supply chain reform for efficient healthcare operations. In the midst of controversy regarding the most influential stimulant for e-procurement adoption, the outcome of this research in a unique way is in consonance with earlier assertion by McGinnis et al (1993) and other researchers, who observed that a well-developed e-procurement care system is stimulated by effective financial resources (C1), technology (C2) and skilled manpower (C3). Thus it is recommended that Ghanaian hospitals should strongly consider the electronic means of procurement as the traditional paper base method of procurement is not sustainable with its associated problems of delays and lack of transparency. Since the hospitals have computers and access to the internet, quitting or reducing the paper base method should not be a problem, however, hospitals ought to be mindful of

the fact that the functional pre-requisites for optimization of e-procurement lies in the prevalence of effective facilitating conditions (socio-cultural conditions (C4), employee motivation (C5), organizational structure (C6), organisational culture (C7), related and support systems or system interoperability (C8), management support (C9). The same can be said of exogenous variables including supplier compatibility (C10), regulatory frameworks such as legal framework (C11), operational standards and benchmarks (C12) and other external/industry pressure (C13)

The findings have many implications for the current attempts to promote e-procurement in the selected hospitals and other that intends to completely overhaul their entire supply chain system in line with modern technology based approaches. Ghanaian hospitals must adopt a holistic approach to implementing e-procurement by orchestrating all the important actors and resources available to it to harness e-procurement solutions towards the attainment of healthcare efficiency in a constantly changing service environment.

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