Business Management Research and Applications: A Cross Disciplinary Journal

ASSESSING THE INTERRELATIONSHIPS AMONG DIGITALISATION, PROCUREMENT, AND HOSPITAL PRODUCTIVITY IN GHANA

Romeo Tetteh-Kofi Calebs | CEO, Oklepeme Group of Companies, U7, KASS Valley Estate, Accra, Ghana

Jodine Marie Burchell, Ph.D. | Columbia Southern University, Orange Beach, Alabama, USA
https://orcid.org/0000-0003-4927-5489

Luh, Peter Kudjo | University of Ghana, Accra, Ghana

Contact: sasraku77@gmail.com

ABSTRACT

This study aimed to examine the interrelationships among digitalization, procurement, and hospital productivity in Ghana. To achieve the study objectives, a questionnaire was used to collect data from respondents from various hospitals nationwide. A quantitative approach was employed for data analysis, utilizing regression analysis to test the study's hypotheses. The results revealed that hospital productivity is enhanced by procurement processes and digitalization in Ghanaian hospitals, as a positive causal effect was established between the variables. Regarding the interactive impact of procurement and digitalization on hospital productivity, the finding is that in the presence of digitalization, procurement regulation is not statistically significantly associated with hospital productivity. In this regard, the study recommends that hospitals make appropriate investments (both financial and non-financial) to ensure that procurement procedures and digitalized systems are efficient in delivering positive productivity.

Keywords*: Digitalization, Procurement, Hospital Productivity, Ghana.*

Introduction and Motivation

The objective of any organization is to deliver oper ational efficiency and effectiveness to achieve organizational success. Fundamentally, one of the top priorities for any organization is to increase operational productivity. Thus, in the current competitive business environment, the application of ICT systems in organizational operations has become the norm, as operations have become more complex, and organizations must adjust to maneuver and achieve a competitive advantage.

The resource-based view (RBV) emphasizes that a firm's unique resources and capabilities are key drivers of competitive advantage (Barney, 1991). In modern supply chain management (SCM), technological competencies and analytical skills significantly influence organizational performance by enhancing efficiencies and supporting dynamic capabilities (Hallikas et al., 2021; Akter et al., 2016; Jacobides & Hitt, 2005; Teece, 2017). Possessing the right technologies and intangible resources enables organizations to achieve improved performance, including profitability, cost savings, and productivity gains (Bauer & Göbl, 2019; Agboola et al., 2019). Digitalization has been widely studied in manufacturing, banking, SMEs, transportation, and construction (Agboola et al., 2019; Bellakhal & Mouelhi, 2023; Leviäkangas, 2016; Berlak et al., 2021), yet relatively less attention has been given to healthcare services.

Procurement, a fundamental organizational activity, ensures the delivery of goods and services, but in the public sector, it often consumes substantial national resources and is hindered by bureaucracy. In Ghana, procurement is governed by the Public Procurement (Amendment) Act, 2016 (Act 914), which seeks to guarantee value for money (Public Procurement Authority, Ghana, 2016). This study argues that digitalizing hospital procurement could significantly enhance service delivery, streamline processes, and improve efficiency, ultimately ensuring value for money and better healthcare outcomes.

It is evident from the above that the role of digitalization and procurement in firm performance cannot be avoided. However, existing studies that have ventured into the subject at hand have primarily concentrated in industries apart from healthcare, resulting in knowledge and context gaps in the literature. Hence, although there exists extensive literature (Agboola et al., 2019; Aghimien et al., 2018; Bento et al., 2022; Berlak et al., 2021; Borowiecki et al., 2021; Flechsig et al., 2021; Mapanga & Garidzirai, 2021; Hallikas et al., 2021; Leviäkangas & Kauppila, 2020; Mollisi, 2017) that deals with the issue of digitalization, procurement, supply chain and firm performance, studies about how digitalization, procurement process and hospital productivity are related in a healthcare setting is still yet to be established in the context of empirical facts.

This study is motivated by inefficiencies in public procurement, particularly in hospitals, where bureaucratic, manual processes delay the acquisition of drugs and resources, undermining productivity. Given the critical nature of healthcare services, such delays hinder effective delivery. While Ghana has seen progress in digital adoption, empirical evidence on how digitalization impacts hospital productivity remains limited. Existing studies have examined

digitalization and procurement but not in relation to hospital performance. This study fills that gap by exploring (i) the link between employee perceptions of digitalization and hospital productivity, (ii) the effect of procurement perceptions on productivity, and (iii) digitalization's moderating role.

Literature Review

This study is underpinned by the Resource-Based View (RBV) and Dynamic Capability Theory (DCT). RBV posits that unique, valuable resources such as IT systems and digital capacity create competitive advantage by enhancing efficiency, productivity, and service quality (Barney, 1991; Brynjolfsson & McElheran, 2019). In hospitals, digitalization strengthens procurement and healthcare delivery (Lioukas et al., 2016). DCT, building on RBV, emphasizes firms' ability to sense, seize, and reconfigure resources to adapt to dynamic environments (Teece, 2007). For hospitals, this means reconfiguring IT systems to improve procurement, innovate processes, and maintain competitiveness through enhanced efficiency and productivity.

Procurement, Digitalization, and Productivity

Procurement, supply chain, digitalization, and productivity concepts and issues have attracted increased academic and policy attention given their critical role to play in determining organizational and national competitiveness. Both at the firm and country levels, digitalization has emerged as a determinant of productivity, enabling enhanced efficiency, innovation, and service provision (Leviäkangas & Kauppila, 2020; Aghimien et al., 2018). Procurement, which is also one of the organizational fundamental functions, is equally important in ensuring efficiency, effectiveness, and performance outcomes (Kermani et al., 2024). Though numerous studies have individually or partially colluded to investigate these topics, there are gaps in context and issues, particularly within the Sub-Saharan African healthcare sector. The reviews in the subsections below bring together the literature on productivity, procurement, and digitalization, with a focus on key findings, conflicts, and gaps.

Digitalization and Productivity

Research on digitalization as a driver of productivity has produced mixed results. At the country level, Leviäkangas and Kauppila (2020) found weak links between ICT investment and productivity in Australia and Finland, affirming Solow's productivity paradox. Similarly, Leviäkangas (2016) observed no significant productivity gains in Finland's transport sector, while Çıdık (2019) noted that organizational and contextual interdependencies constrained digitalization's impact in construction. Despite these limitations, several studies report positive effects. Aghimien et al. (2018) found digital tools improved time efficiency and productivity in South Africa's construction industry. Berlak et al. (2021) emphasized that digital technologies boost productivity in German firms but require behavioral acceptance. Firm-level evidence from Borowiecki et al. (2021) showed that digital adoption and skills significantly increased productivity in Dutch firms, particularly younger ones. Likewise, Falentina et al. (2021) linked

internet use to higher labor productivity in Indonesian SMEs, while Aly (2022) highlighted digitalization's broader benefits for growth and employment in developing countries. In banking, Agboola et al. (2019) and Gul et al. (2021) found positive impacts in Nigeria and Pakistan, respectively, though the moderating effect of dynamic capabilities was weak. Overall, evidence suggests digitalization enhances productivity, but outcomes depend on industry, skills, and institutional readiness.

Procurement and Productivity

Procurement is also a major driver of organizational performance and involves the acquisition of goods, works, and services (Van Weele, 2018; McFalls, 2016). Procurement best practice enhances efficiency, effectiveness, and overall productivity (Kermani et al., 2024). Empirical literature consistently reports this relationship, yet outputs differ across contexts. In Ghana, Anane et al. (2019) found that procurement policy, planning, and sustainable procurement significantly improved service delivery at the Volta River Authority. Anane (2020) found that green purchasing positively affected organizational performance at Bayport Savings and Loans and Ghana Water Company, with supplier collaboration moderating this effect. Maruri and Kiarie (2015) also found the same result at GT Bank in Kenya, where procurement practices, e-procurement, and contract management significantly contributed to performance. Semuel et al. (2018) complemented that negotiation strategy and relations between buyer-supplier mediate the impact of strategic purchasing to performance. More broadly, Bento et al. (2022) demonstrated that public procurement of innovation (PPI) is positively correlated with GDP per capita across 30 European countries, and Shin and Lee (2022) demonstrated that PPI in Korea increases firm productivity through value-added growth. Mollisi (2017), analyzing Italy's District Heating industry, established that PPP contracts internalize technological externalities positively affecting productivity.

Digitalization and Procurement

Procurement is increasingly shaped by digitalization, which enhances efficiency, transparency, and strategic value. Hallikas et al. (2021) demonstrated that digital procurement and data analytics improve supply chain performance, with digital tools moderating firm outcomes. Similarly, Bauer and Göbl (2019) showed that integrated systems reduce manual effort and enhance efficiency. Case studies confirm this trend: Cheptora et al. (2018) found ICT improved procurement at Kenya's Nzoia Sugar Company, though infrastructure was a challenge; Zouari et al. (2021) linked digital maturity to resilience; and Flechsig et al. (2021) and Viale and Zouari (2020) showed Robotic Process Automation (RPA) enhances quality, cost savings, and efficiency, but is constrained by IT resources and readiness. Emerging technologies like blockchain also support procurement by reducing opportunism and costs and ensuring transparency (Schmidt & Wagner, 2019), while e-procurement elevates procurement from an administrative to a strategic function (Seyedghorban et al., 2020). Procurement 4.0 further expands this role, enhancing remanufacturing, circular economy, transparency, and efficiency

(Bag et al., 2020, 2021; Mapanga & Garidzirai, 2021). Structural and organizational factors remain critical, as digitalization combined with centralization improves performance (Patrucco et al., 2021), while traditional procurement systems are increasingly obsolete (Noveen, 2020). Overall, digitalization transforms procurement into a strategic, value-creating function.

Research Gap

Despite abundant literature, there are underlying gaps. Contextually, most studies focus on developed or advanced economies, with limited attention to Sub-Saharan Africa, particularly the healthcare sector (Chang, 2017; Mapanga & Garidzirai, 2021). Further, there are gaps in the literature: very few studies address digitalization, procurement, and productivity as an integrated framework. For instance, while procurement has been explored in relation to performance (Anane et al., 2019; Kermani et al., 2024), and digitalisation in relation to productivity (Borowiecki et al., 2021; Gul et al., 2021), little attention has been paid to digitalisation as a moderating mechanism through which procurement processes enhances productivity. Hospitals, as critical public institutions, have been underexplored despite the sector's reliance on efficient procurement to deliver quality healthcare.

Methods and Variables

This study employed a quantitative, correlational design to examine the relationship between digitalization, procurement, and hospital productivity in Ghana. Quantitative methods were suitable for statistical measurement, hypothesis testing, and generalization of findings (Fryer et al., 2018; Walter & Andersen, 2013), while a correlational design helped establish the direction and strength of relationships between variables (Al-Ansary et al., 2013). The study population included public and private hospitals, of which 170 were managed by the Ghana Health Service (GHS). Based on Yamane's (1967) formula, a minimum of 169 hospitals was required, but 232 usable responses were collected, strengthening generalizability. A multi-stage sampling approach was used: hospitals were stratified into regional, district, and mission categories, purposive sampling identified knowledgeable respondents, and convenience sampling engaged available participants.

Data were collected through a standardized questionnaire with three sections: digitalization, procurement practices, and hospital productivity. Constructs were adapted from prior studies (Bag et al., 2020; Tajudeen et al., 2022; Zouari et al., 2021; Kiage, 2013; Selomo & Govender, 2016; Thai, 2001; Cleven et al., 2016). A pilot test ensured clarity and contextual relevance. Data collection, conducted across 16 regions over five months, followed informed consent protocols. Reliability was confirmed using Cronbach's Alpha (≥ 0.7) (George & Mallery, 2003; Rovai et al., 2013). Data analysis employed SPSS, including descriptive and inferential statistics, such as Shapiro-Wilk tests, correlation, and regression.

Ethical standards were followed strictly. Voluntary participation was ensured, and the respondents' right to withdrawal was never revoked. Informed consent was obtained from all participants after clear explanation of the study's purpose. Anonymity and confidentiality were

guaranteed by removing individual identifiers and protecting data using passwords and secure backups. There was no coercion of any form, and formal approvals were obtained from all participating hospitals.

A multiple regression model was employed to test the predictive potential of the independent variables, as based on Makokha (2017):

$$Y=a+\beta 1X1+\beta 2X2+\varepsilon \quad \textbf{(1)}$$

Where:

- Y = Hospital productivity
- X1 = Digitalization
- X2 = Procurement operations
- ε = Error term

Model 1 enabled the estimation of each predictor's contribution in adjusting for unobserved variables. Regression results were presented in tables with levels of significance.

Results and Analysis

Data analysis involved assessing the reliability and internal consistency of the scales, using Cronbach's Alpha, and confirming data normality by the Shapiro-Wilk W test. Descriptive statistics, correlation matrix, and regression analyses were then conducted to address the research questions.

Exploratory Data Analysis

This section presents basic data on the hospitals, as obtained from respondents, descriptive statistics, tests of normality, and Cronbach's Alpha. From Table 1, institutions sampled were 46 regional hospitals, 70 district hospitals, 17 mission hospitals, and 15 others. District hospitals dominated the sample since they are also the most prevalent in Ghana. In addition, the data in Table 1 shows that respondents have varying years of work experience ranging from 1 year to 10 years.

Table 1
Demographics

Item	**Category**	**N**	**%**
Hospital Type	Regional Hospital	46	31.1
	District Hospital	70	47.3
	Mission Hospital	17	11.5
	Others	15	10.2
		147	**100**

Number of Years in Service	1	22	14.9
	2	49	33.1
	3	35	23.6
	4	19	12.8
	5	13	8.8
	6	1	0.7
	7	3	2
	8	2	1.4
	9	2	1.4
	10	2	1.4
		147	**100**

Scale reliability test

Table 2 reports scale reliability results. Digitalization (9 items) had a Cronbach's Alpha (CA) of 0.808, procurement processes (26 items) scored 0.712, and hospital productivity (32 items) 0.718. Following Taber (2018), all CA values exceed 0.70, confirming strong internal consistency and effective measurement of the study variables.

Table 2
Scale Reliability Test

Construct	Number of Items	Cronbach Alpha Coefficient
Digitalization	9	0.808
Procurement	26	0.712
Hospital Productivity	32	0.718

Source: Field data

Testing for Data Normality

In Table 3, the statistical values indicate whether the empirical data are normally distributed. The Shapiro-Wilk and Kolmogorov-Smirnov tests were employed to assess data normality (see Table 3). While both provided similar results, the study prioritized the Shapiro-Wilk test, given its suitability for smaller samples and its assumption that data originate from a normally distributed population. The null hypothesis posits normal distribution, while the alternative suggests deviations. Using the decision rule of $p < 0.05$ for rejection, results showed p-values above 0.05 for digitalization, procurement, and hospital productivity. Thus, the null hypothesis was accepted, confirming no significant deviations from normality across all three variables.

Table 3
Test for normal distribution of data

	Kolmogorov-Smirnov[a]	Shapiro-Wilk

	Statistic	df	Sig.	Statistic	df	Sig.
Digital	.069	147	.082	.989	147	.268
ProcuR	.094	147	.003	.984	147	.088
HP	.067	147	.200*	.990	147	.397

Descriptive statistics

Table 4 provides a snapshot of the descriptive statistics, including sample size (N), means, minimum and maximum values, standard deviation, skewness, and kurtosis. Of relevance are the mean scores, which indicate that respondents generally strongly agreed with the items on each scale. This is reflected in the mean values of 5 or higher reported across the constructs, suggesting positive perceptions of digitalization, procurement, and hospital productivity.

Table 4
Descriptive statistics

Variable	N	Min	Max	Mean	St Deviation	Skewness	Kurtosis
HP	147	5.130555	6.433333	5.776127	.274174	-.021	-.310
ProcuR	147	5.320535	6.437500	5.903304	.227546	-.235	.063
Digital	147	3.555555	6.555555	5.080876	.616114	.186	-.191

Note: HP-Hospital productivity; ProcuR-Procurement regulation; Digital-Digitalisation

Pairwise correlation

Table 5 presents the correlation matrix of the study variables. Results reveal positive associations between procurement processes and hospital productivity, as well as between digitalization and hospital productivity. This suggests that improvements in procurement systems and digitalization correspond with higher hospital productivity, though correlations do not imply causality.

Table 5
Pairwise correlations

		HP	**ProcuR**	**Digital**
HP	Pearson Correlation	1	.227**	.196*
	Sig. (2-tailed)		.006	.017
	N	147	147	147
ProcuR	Pearson Correlation	.227**	1	.105
	Sig. (2-tailed)	.006		.207
	N	147	147	147
Digital	Pearson Correlation	.196*	.105	1

	Sig. (2-tailed)	.017	.207	
	N	147	147	147
**. Correlation is significant at the 0.01 level (2-tailed).				
*. Correlation is significant at the 0.05 level (2-tailed).				

Note: HP-Hospital productivity; ProcuR-Procurement regulation; Digital-Digitalisation

Inferential Findings

Table 6 shows that both procurement and digitalization significantly enhance hospital productivity in Ghana, with procurement having a larger effect (0.27) than digitalization (0.084). This highlights that while both factors are critical, procurement reforms yield more substantial productivity gains. Procurement has long been central to organizational effectiveness, especially in the public sector, where regulations like Ghana's Public Procurement Act ensure value for money (Musau, 2015; Schapper et al., 2006). The findings confirm that effective procurement processes, including planning, standardized policies, supplier negotiations, and efficiency, are vital to promoting productivity. Strong procurement frameworks mitigate the risks posed by poor-quality suppliers, reduce waste, and ensure responsiveness to market shifts and emergencies (Mishra et al., 2022; Dube et al., 2022). Streamlined processes also reduce inefficiencies, improve staff focus on core tasks, and boost morale, reinforcing hospital productivity.

Digitalization also plays a significant role by automating administrative functions, optimizing resource use, and enabling faster communication and collaboration. It reduces redundancies, minimizes errors, lowers costs, and saves time, directly improving healthcare service delivery (Al-Jaroodi et al., 2020; Avinash & Joseph, 2024). The study rejects both null hypotheses, confirming strong positive relationships between procurement, digitalization, and hospital productivity, with procurement emerging as the more influential factor.

Table 6

Effect of procurement processes and digitalization on hospital productivity

HP	Coef.	St.Err.	t-value	p-value	[95% Conf	Interval]	Sig
Digital	.084	.028	3.05	.003	.03	.139	***
ProcuR	.27	.077	3.48	.001	.117	.423	***
Constant	3.602	.565	6.38	0	2.485	4.718	***

Mean dependent var	5.776	SD dependent var	0.274
R-squared	0.103	Number of obs	147
F-test	8.299	Prob > F	0.000
Akaike crit. (AIC)	25.696	Bayesian crit. (BIC)	34.667

*** *p<.01,* ** *p<.05,* * *p<.1*

Note: HP-Hospital productivity; ProcuR-Procurement regulation; Digital-Digitalisation

The findings from Table 7 show that while procurement positively influences hospital productivity, the addition of digitalization makes both effects statistically insignificant. This

indicates that digitalization does not moderate the impact of procurement on productivity. The result suggests that poor implementation, a lack of skilled personnel, limited system customization, or user bypass may undermine the benefits of digitalization. Barriers such as inadequate training, insufficient knowledge, resistance to change, and poor integration with other hospital systems, such as inventory management or patient records, reduce the potential for synergies and hinder productivity gains (Althabatah et al., 2023; Bag et al., 2020). Moreover, non-digitally integrated suppliers and customers limit efficiency. These outcomes emphasize that while procurement policies and digitalization independently improve productivity, their combined effect is not guaranteed. Often, digitalization reinforces existing processes rather than fostering innovation, constraining productivity improvements. The findings align with the resource-based view (RBV), which holds that procurement and digital systems are valuable organizational resources that, when effectively deployed, enhance competitiveness (Barney, 1991). From the dynamic capabilities theory (DCT) perspective, hospitals need to reconfigure and adapt systems to evolving environments continuously (Teece, 2007). Thus, well-designed digital tools, integrated with procurement processes, can yield sustainable productivity and competitiveness in healthcare institutions.

Table 7

Moderating effect of digitalization in the nexus between procurement and hospital productivity

HP	Coef.	St.Err.	t-value	p-value	[95% Conf	Interval]
ProcuR	.095	.779	0.12	.903	-1.444	1.634
Digitalise	-.099	.874	-0.11	.91	-1.827	1.629
ProcuR*Digital	.03	.147	0.20	.84	-.261	.32
Constant	4.827	4.627	1.04	.299	-4.319	13.973

Mean dependent var	5.776	SD dependent var	0.274
R-squared	0.082	Number of obs	147
F-test	4.231	Prob > F	0.007
Akaike crit. (AIC)	31.177	Bayesian crit. (BIC)	43.138

*** *p<.01, ** p<.05, * p<.1*

Note: HP-Hospital productivity; ProcuR-Procurement regulation; Digital-Digitalisation

Summary, Implications, and Recommendations

Summary

Digitalization and Hospital Productivity. The study reaffirmed digitalization as a prime driver of enhanced hospital productivity. As postulated by the resource-based view (RBV), technology is seen as a strategic asset that, when properly managed, can increase efficiency. In the same vein, dynamic capability theory (DCT) also supports this finding, highlighting the need for

organizations to adapt and interact with matching digital systems to survive. Hospitals that invest in digital technologies achieve operational and economic benefits, including improved service delivery and resource optimization.

Procurement Processes and Hospital Productivity. The result also revealed procurement as a key driver of hospital productivity. Hospitals in Ghana must give significant attention to efficient procurement systems, which serve as strategic structural resources within the RBV framework. Effective procurement optimizes resources, reduces inefficiencies, and enhances productivity. These results reinforce the strategic value of supply chain and resource management for the provision of healthcare, signaling that procurement processes should never be viewed as an administrative procedure but a central strategic asset.

Procurement, Digitalization, and Hospital Productivity. Although procurement and digitalization were each found to be positively related with hospital productivity, no complementary or interactive effect of the two was determined by the study. It suggests that the hospitals perceive and utilize such resources independently rather than interactively. The findings agree with RBV's argument that organizational resources are major drivers of productivity but also highlight the significance of adaptation and strategic fit as argued by the DCT.

Implications

Theoretical Implications. The study is theoretically significant. Firstly, it empirically validates RBV theory by demonstrating that procurement systems and digital infrastructure are valuable, rare, and non-substitutable resources that serve as strategic assets for hospitals. Far from being peripheral support functions, procurement and digitalization are shown to be core drivers of organizational productivity. Second, the findings reinforce DCT, showing how hospitals can reconfigure resources and adapt operational routines in response to technological changes and external demands. The positive relationship between digitalization and productivity signals how hospitals build dynamic capabilities by aligning themselves with technological advancements. Likewise, effective procurement involves adapting supply chains and vendor relationships to achieve efficiency goals.

From a practical perspective, RBV and DCT offer us a two-way lens, signaling that digitalization and procurement are static assets and dynamic change facilitators. Hospital productivity is not only the outcome of external determinants but also very much an issue of how well internal resources and capabilities are constructed, mobilized, and recombined.

Implications for Professional Practice

The study also provides practical implications for health managers and policymakers:

Strategic Procurement. Hospitals must transform procurement from a back-office function to a strategic facilitator of service delivery. Structured, data-driven procurement processes like

supplier relationship management, inventory optimization, and transparent sourcing can deliver timely access to supplies, minimize waste, and reduce inefficiencies.

Digital Transformation. Healthcare managers must go out of their way to drive digital transformation by investing in technologies such as electronic health records, automated purchasing systems, and data analytics. However, success requires more than just acquisition; implementation into workflows and training individuals are also required. Collaboration between IT staff, clinicians, and administrators is vital to ensure systems align with operational needs and improve decision-making and patient care.

Dynamic Capabilities. Hospitals must facilitate agility and flexibility through building dynamic capabilities such as sensing, seizing, and reconfiguring. These encompass leadership development, cross-functional collaboration, and a culture of innovation and continuous learning, enabling hospitals to respond to regulatory change, technological disruption, and shifting patient needs.

Recommendations

Future Research

The study limited its scope to hospitals in Ghana. Future studies should consider more specific procurement areas, such as tendering procedures, contracting negotiations, vendor management, and inventory management, and their effects on productivity. Comparative studies across various hospital categories (public and private, teaching and non-teaching, urban and rural) could provide further insights. Moreover, future research must investigate which digitalization tools (e.g., e-inventory systems) contribute most significantly to productivity and whether digital leadership and governance influence these relationships.

Practice

Hospitals must prioritize procurement improvements by hiring qualified staff, implementing competitive sourcing strategies, leveraging data analysis, and building long-term relationships with vendors. Additionally, digital infrastructure must be introduced with caution to ensure usability, connectivity, and employee training, in a bid to achieve maximum impact. Hospitals must also invest in organizational agility through continuous improvement and innovativeness. This can be achieved by empowering frontline staff, promoting cross-functional collaboration, and embedding flexibility in decision-making processes.

References

Adinyira, E., Agyekum, K., Manu, P., Mahamadu, A. M., & Olomolaiye, P. (2021). Lessening procurement deviations using procurement post reviews: evidence from Ghana. *Journal of Financial Management of Property and Construction*. https://doi.org/10.1108/JFMPC-05-2020-0038.

Agboola, M. G., Awobajo, K. A., Oluwatobi, S. O., Akinbode, M. O., Fagbohun, M. O., Esse, U. C., & Betek, C. M. (2019). Effect of digitalization on the performance of commercial

banks in Nigeria. In *IOP Conference Series: Earth and Environmental Science*, *331*(1), 012014. https://doi.org/10.1088/1755-1315/331/1/012014

Aghimien, D., Aigbavboa, C., Oke, A., & Koloko, N. (2018). Digitalization in construction industry: Construction professionals' perspective. In *Proceedings of the Fourth Australasia and South-East Asia Structural Engineering and Construction Conference, Brisbane, Australia* (pp. 3-5). URL: Digitalisation-in-construction-industry-construction-professionals-perspective.pdf (researchgate.net)

Akter, S., Wamba, S. F., Gunasekaran, A., Dubey, R., & Childe, S. J. (2016). "How to improve firm performance using big data analytics capability and business strategy alignment?", *International Journal of Production Economics*, *182*, 113-131, http://doi: 10.1016/2016.08.018.

Alam, M. M., & Wagner, C. (2013). Assessing the impact of digital procurement via mobile phone on the agribusiness of rural Bangladesh: A decision-analytic approach. *Agribusiness and Information Management*, *5*(1), 31-41. https://koreascience.kr/article/JAKO201307559763257.pdf

Albano, G. L., & Sparro, M. (2010). Flexible strategies for centralized public procurement. *Review of Economics and Institutions*, *1*(2), Article 4. http://dx.doi.org/10.5202/rei.v1i2.17

Althabatah, A., Yaqot, M., Menezes, B., & Kerbache, L. (2023). Transformative procurement trends: Integrating industry 4.0 technologies for enhanced procurement processes. *Logistics*, *7*(3), 63. https://doi.org/10.3390/logistics7030063

Aly, H. (2022). "Digital transformation, development and productivity in developing countries: is artificial intelligence a curse or a blessing?", *Review of Economics and Political Science*, Vol. 7 No. 4, pp. 238-256. https://doi.org/10.1108/REPS-11-2019-0145

Anane, A., Adoma, V., & Awuah, G. (2019). The effect of procurement practices on service delivery: a case study of VRA, Ghana. *Asian Journal of Economics, Business and Accounting*, *13*(1), 1-23. https://doi.org/10.9734/AJEBA/2019/v13i130164

Avinash, B., & Joseph, G. (2024). Reimagining healthcare supply chains: a systematic review on digital transformation with specific focus on efficiency, transparency and responsiveness. *Journal of Health Organization and Management*, *38*(8), 1255-1279. https://doi.org/10.1108/JHOM-03-2024-0076.

Bag, S., Dhamija, P., Gupta, S., & Sivarajah, U. (2021). Examining the role of procurement 4.0 towards remanufacturing operations and circular economy. *Production Planning & Control*, *32*(16), 1368-1383. https://doi.org/10.1080/09537287.2020.1817602

Bajpai, A., & Misra, S. C. (2022). Barriers to implementing digitalization in the Indian construction industry. *International Journal of Quality & Reliability Management*, *39*(10), 2438-2464. https://doi.org/10.1108/IJQRM-09-2020-0318

Barney, J. B. (1991). "Firm resources and sustained competitive advantage", Journal of Management, *17*(1), (pp. 99-120). https://doi.org/10.1177/014920639101700108

Barney, J. (1986). 'Strategic factor markets: expectation, luck and business strategy.' Management Science, *42*, 1231–41. https://doi.org/10.1287/mnsc.32.10.1231

Bauer, F., & Göbl, M. (2019). The influence of digitalization on procurement efficiency. *Journal of Applied Leadership and Management*, *7*, 50-65. http://hdl.handle.net/10419/215721

Bellakhal, R., & Mouelhi, R. (2023). Digitalisation and firm performance: Evidence from Tunisian SMEs. *International Journal of Productivity and Quality Management*, *39*(1), 42-65. https://south.euneighbours.eu/wp-

content/uploads/2022/07/emnes_wp_036_digitalisation_firm_performance_tunisian_smes.pdf

Bento, N., Sousa, C., Trindade, P., Mamede, R. P., Fontes, M., & Alves, T. (2022). Robust relation between public procurement for innovation and economic development. *Economics Letters*, *211*, 110241. https://doi.org/10.1016/j.econlet.2021.110241

Berlak, J., Hafner, S., & Kuppelwieser, V. G. (2021). Digitalization's impacts on productivity: a model-based approach and evaluation in Germany's building construction industry. *Production Planning & Control*, *32*(4), 335-345.

Bienhaus, F., & Haddud, A. (2018). Procurement 4.0: factors influencing the digitization of procurement and supply chains, *Business Process Management Journal*, Vol. *24*(4), 965-984. http://doi.org/10.1108/BPMJ-06-2017-0139.

Borowiecki, M., Pareliussen, J., Glocker, D., Kim, E. J., Polder, M., & Rud, I. (2021). The impact of digitalization on productivity: Firm-level evidence from the Netherlands. *OECD Economics Department Working Papers*, No. 1680, OECD Publishing, Paris, https://doi.org/10.1787.

Chang, W. (2017). An Empirical Study on the Effects of Public Procurement on the Productivity and Survivability of SMEs: Case of the Korean Mining and Manufacturing Sectors. *KDI Journal of Economic Policy*, *39*(1), 1-18. http://dx.doi.org/10.23895/kdijep.2017.39.1.1

Falentina, A. T., Resosudarmo, B. P., Darmawan, D., & Sulistyaningrum, E. (2021). Digitalization and the Performance of Micro and Small Enterprises in Yogyakarta, Indonesia. *Bulletin of Indonesian Economic Studies*, *57*(3), 343-369. https://doi.org/10.1080/00074918.2020.1803210

Flechsig, C., Anslinger, F., & Lasch, R. (2021). Robotic Process Automation in purchasing and supply management: A multiple case study on potentials, barriers, and implementation. *Journal of Purchasing and Supply Management*, 100718. https://doi.org/10.1016/j.pursup.2021.100718

Gal, P., Nicoletti, G., von Rüden, C., Sorbe, S., & Renault, T. (2019). Digitalization and productivity: in search of the holy grail-firm-level empirical evidence from European countries. *International Productivity Monitor*, *37*(Fall), 39-71. Available at http://www.csls.ca/ipm/37/OECD.pdf

Gul, R., Ellahi, N., Leong, K., & Malik, Q. A. (2021). The complementarities of digitalization and productivity: redefining boundaries for financial sector. *Technology Analysis & Strategic Management*, 1-13. https://doi.org/10.1080/09537325.2021.2013463

Hallikas, J., Immonen, M., & Brax, S. (2021). Digitalizing procurement: the impact of data analytics on supply chain performance. *Supply Chain Management: An International Journal, 26(5), 629-646*. http://doi.org/10.1108/05-2020-0201.

Leviäkangas, P. (2016). Digitalization of Finland's transport sector. *Technology in Society*, *47*, 1-15. https://doi.org/10.1016/j.techsoc.2016.07.001

Leviäkangas, P., & Kauppila, O. (2020). Digitalization of industries: a comparative analysis from Australia and Finland. *International Journal of Technology, Policy and Management*, *20*(1), 70-89. https://doi.org/10.1504/IJTPM.2020.104868

Mapanga, A., & Garidzirai, R. (2021). The impact of Procurement 4.0 on value chain management in public sector organizations. *Journal of Management Information and Decision Sciences, 24*(S4), 1–15. Retrieved from

https://www.abacademies.org/articles/the-impact-of-procurement-4-0-on-value-chain-management-in-public-sector-organizations-12305.html

Musau, E. G. (2015). Determinants of procurement function and its role in organizational effectiveness. *Journal of Business Management, 17*(2), 12–25. https://doi.org/10.9790/487X-17231225

Noveen, W. (2020). Industry 4.0 and its impact on procurement in supply chain. *International Journal of Social, Political and Economic Research*, *7*(1), 15-25. https://doi.org/10.46291/IJOSPERvol7iss1pp15-25

Ofori, D., & Fuseini, O. I. (2020). Electronic government procurement adoption in Ghana: Critical success factors. *Advances in Research, 21*(3), 18–34. https://doi.org/10.9734/air/2020/v21i330190

Patrucco, A. S., Agasisti, T., & Glas, A. H. (2021). Structuring public procurement in local governments: the effect of centralization, standardization and digitalization on performance. *Public performance & management review*, *44*(3), 630-656. https://doi.org/10.1080/15309576.2020.1851267

Selomo, M. R., & Govender, K. K. (2016). Procurement and Supply Chain Management in government institutions: A case study of select departments in the Limpopo Province, South Africa. *Dutch Journal of Finance and Management*, *1*(1), 1-10. https://doi.org/10.20897/lectito.201637

Seyedghorban, Z., Samson, D., & Tahernejad, H. (2020). "Digitalization opportunities for the procurement function: pathways to maturity", *International Journal of Operations & Production Management*, Vol. 40 No. 11, pp. 1685-1693. https://doi.org/10.1108/IJOPM-04-2020-0214

Sheng, M. L., & Hartmann, N. N. (2019). "Impact of subsidiaries' cross-border knowledge tacitness shared and social capital on MNCs' explorative and exploitative innovation capability," Journal of International Management, *25*(4), 100705-100721. https://doi.org/10.1016/j.intman.2019.100705

Sjödin, D., Kamalaldin, A., Parida, V., & Islam, N. (2021). Procurement 4.0: How industrial customers transform procurement processes to capitalize on digital servitization. *IEEE Transactions on Engineering Management*, *70*(12), 4175-4190. https://doi.org/10.1109/TEM.2021.3110424

Solomon, E. M., & van Klyton, A. (2020). The impact of digital technology usage on economic growth in Africa. *Utilities policy*, *67*, 101104. https://doi.org/10.1016/j.jup.2020.101104

Teece, D. J. (2017). "Business models and dynamic capabilities," Long Range Planning, *51*(1), 40-49. https://doi.org/10.1016/j.lrp.2017.06.007

Teece, D. J. (2007). "Explicating Dynamic Capabilities: The Nature and Micro foundations of (Sustainable) Enterprise Performance." *Strategic Management Journal 28*(13), 1319–1350. https://doi.org/10.1002/smj.640

Vega, D., Arvidsson, A., & Saïah, F. (2023). Resilient supply management systems in times of crisis. *International Journal of Operations & Production Management*, *43*(1), 70-98. https://doi.org/10.1108/IJOPM-03-2022-0192