THE IMPACT OF PROCUREMENT 4.0 ON VALUE CHAIN MANAGEMENT IN PUBLIC SECTOR ORGANIZATIONS

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ABSTRACT

The paper sought to fill the theoretical and empirical knowledge gaps relating to the implication of procurement 4.0 on the South African public sector value chain management. A cross-sectional survey research design with an online questionnaire was employed to gather opinions on the implications of Procurement 4.0 on value chain management in South Africa's public sector.

The complex South African public sector analysis indicates that Procurement 4.0 has several implications on value chain management, demanding a paradigm shift in managing these entities. The study also shows that Procurement 4.0's intelligent and connected technologies impact value chain management in South Africa's public sector organisations in value creation and delivery, efficiency, total costs, agility, flexibility and resiliency. Moreover, procurement 4.0's ability to connect the data across suppliers and other stakeholders' value chains brings transparency and collaboration, reducing frictional drag upon the value chain management performance. It was also apparent that the implementation of Procurement 4.0 necessitates a new skill set for procurement officials.

Full implementation of Procurement 4.0 can increase the effectiveness, efficiency, transparency, and accountability of value chain management in public sector organisations in South Africa and public service delivery.

Keywords: Procurement processes, Value chain management, South Africa, Public service delivery.

INTRODUCTION

The ability of any public sector organisation to create social and economic value is naturally dependent on that organisation using its resources to access external goods and services. Across the world, it has become clear that public sector procurement influences a country's economic performance- often contributing enormously to the gross domestic product. Moreover, given the stringent Covid-19 lockdown mandates worldwide, it has become clear that all value chains are susceptible to disasters and emergencies, calling for more innovative procurement praxes vis-a-vis traditional procurement systems. The experience with the Covid-19 pandemic has, without doubt, alerted the world of the realistic role of industry 4.0 in sustaining both private and public sector value chains in times of disaster. Because public sector organisations are always at the forefront of disaster alleviation efforts, it becomes even more urgent for such organisations to implement industry 4.0 to ensure sustainable social and

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economic value to citizens and private sector enterprises. As industry 4.0 entails automation and data exchange technologies, it should be instrumental in the procurement processes in the public sector. Predictions point to the notion that procurement 4.0, if implemented in the public sector organisations, can deter the typical ills associated with traditional value chain management in the public sector, such as expenditure inefficiencies and fiscal erosions.

Nevertheless, persistent arguments continue to dispel the utility of procurement 4.0 as some strategic tool for the public sector organisations whose ability to create and provide socio-economic value is increasingly predicted on effective and efficient value chain management. For example, Aboelmaged (2014) decries that not every procurement 4.0 in organisations is successful, thereby giving impetus to some worrying indecisions regarding complete procurement 4.0 implementation in the public sector organisations. Furthermore, apart from some spirited private sector opinion, it seems there has been no evidence at hand that gives practical insight concerning the implications of procurement 4.0 on value chain management in the public sector organisations. In South Africa, studies on the public sector acutely implicate procurement 4.0's efficacy in achieving cost-saving and economies of scale are concerned (Fourie & Malan, 2020). For instance, for the three years from 2018 to 2020 fiscal years, audit reports have persistently indicated close to 98 per cent of South Africa's 257 municipalities and 21 municipal entities' procurement processes. This challenge happens despite Public Finance Management Act (PFMA)'s procurement 4.0 value chain management strategy.

In light of the scope and impact of public sector procurement on South Africa's socio-economic well-being, it becomes critical to determine the implication of procurement 4.0 on value chain management in the South African public sector organisations. Unravelling such implications should assist governmental decision-making on the next stage of implementing procurement 4.0 in the public sector beyond political rhetoric. Thus, sustainable procurement and, by extension, the delivery of effective public services. This paper aims at filling the theoretical and empirical knowledge gaps relating to the implication of procurement 4.0 on value chain management in the South African public sector organisations. In the end, we propose a framework on how to enhance value chain management in the South African public sector. Apart from this introductory section, this paper comprises four other sections. Section 2 presents a theoretical framework on the envisioned implication of procurement 4.0 on value management. Section 3 describes the research methodology applied in this study, including instrument development, sample and data collection, participants profile, data analysis methods, and instrument reliability and validity testing. Subsequently, Section 4 presents data analysis and the results of the study. Lastly, Section 5 concludes the study by showing the conclusions, implications of the findings, and limitations and suggestions for future research.

THEORETICAL FRAMEWORK AND HYPOTHESES

To survive and succeed in the 21st Century's volatile business environment, businesses should by all means possible seek to make maximum use of all the resources at their disposal in order. Undisputedly, effective employment of procurement methodologies and strategies remains the single most available practical pathway to managing the constant flux in product life cycles, prices and costs (Meehan et al., 2017; Paesbrugghe et al., 2017). Procurement is the process of acquiring value-based goods and services for the organisation to operate. Value chain management (VCM) relates to the process of monitoring and managing all the components that

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comprise manufacturing, including procurement, production, quality control and distribution of value-based goods (Nagy et al., 2018). Other scholars (Kache & Seuring, 2017; Zhang et al., 2019) point to value chain management as the integrated planning and scheduling of the supply chain, comprehensive management of organisational resources, optimisation of supply chain-wide resources integration of vendor or customer information and ensuring cycle time responsiveness. Porter (1998) earlier classified the required activities for organisational value creation in primary and supporting activities. In this arrangement, procurement is one of the support activities in the value chain that needs to be optimised.

Heppelmann and Porter (2014) applaud the internet and information communication technologies' immense role in enlarging procurement in the value chain management. They maintain that procurement allows for value chain efficiency, effectiveness, and profitability, implying that procurement 4.0 has developed into a critical and strategic interface highly contextualised in value chain management (Soosay & Kannusamy, 2018). Indeed, as procurement becomes more digital, its catalytic value also increases as reflected in its increased ability to broker critical knowledge and competencies between the external and internal business partners, thereby ensuring that enterprises in the value chain become market leaders (Rejeb et al., 2019). For Van Weele (2018), procurement 4.0 is a new step exchange needed to ensure the efficient processing of transactions, organisation and management of whole supply chains over the life cycle of the products. Shale et al. (2015) explains that electronic procurement (procurement 4.0) corresponds to the digital web-enabled and other electronic data exchange tools implemented by organisations to support the efficient handling of purchasing transactions to achieve a competitive advantage, as intimated in subsequent discussions.

In the same backdrop, Becker (2018) anticipates that procurement 4.0 (P4.0) might have a more significant role in fostering the competitiveness of organisations by explicitly identifying a positive correlation between procurement 4.0 and value chain management transparency. As per the prediction of Williams and Ehiabhi (2021), transparency in the procurement system allows the involved stakeholders real-time access to the relevant procurement information for easier decision-making. Similarly, Nicoletti (2018) predicts that the advent of Procurement 4.0 should foster trustful relationships owing to the visibility and traceability of all the procurement decision-making processes in the value chain.

With transparency in the procurement system, accountability would ensue so strengthening the governance of the system (Rotich & Okello, 2015; Mackey & Cuomo, 2020) and reducing the cost of maverick sourcing (Glas & Kleemann, 2016; Rejeb et al., 2019; Nicoletti, 2020a). Importantly, all modern-day procurement 4.0 systems comprise three integrated procurement modules in the form of e-sourcing, e-transactions (e-Marketplaces) and e-payment platforms. These platforms allow the automation of the entire procurement cycle (all contractual processes such as online auctions, bidding and tendering and requests for quotations) with current and potential suppliers via online platforms (Khuan & Swee, 2018). Besides, procurement partners can meet via the internet and do business to business (B2B), government to business (G2B), as well as Government to Government (G2G) transactions (Deshmukh, 2020). Notably, the possibility of sending money via the internet for the purchase of goods and services presents realistic opportunities for secure, efficient and effective value chain management (Nicoletti, 2020b). Tracing these metrics allows us to determine the implications of Procurement 4.0 on value chain management systems and find ways to improve the entire process.

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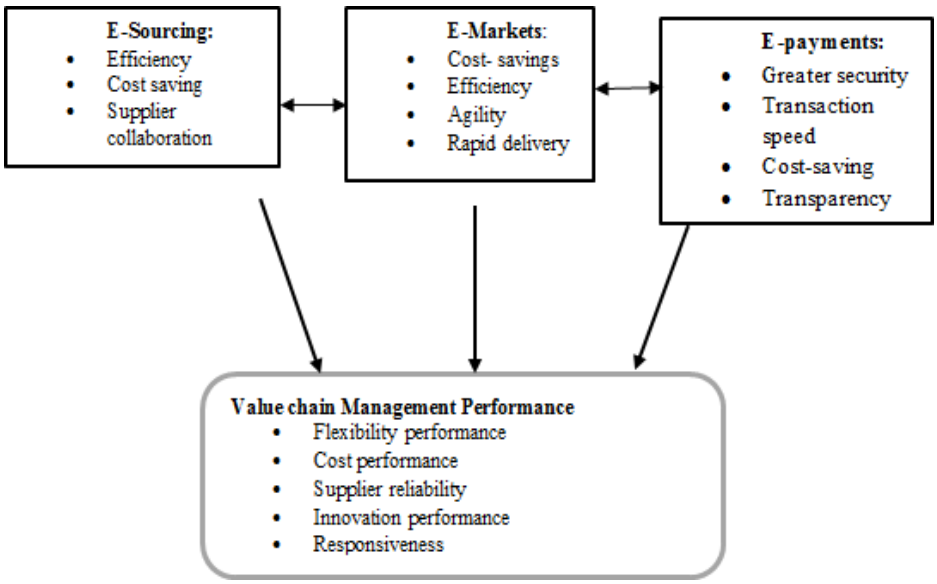

Source: Adapted from Hassan et al. (2020) and Mutangili (2019).

FIGURE 1

CONCEPTUAL FRAMEWORK FOR IMPLICATIONS OF PROCUREMENT 4.0 ON VALUE CHAIN MANAGEMENT

Variables and Hypothesis Formulation

Figure 1 draws attention to the variables predicting the implications of procurement 4.0 on value chain management performance. These include those presented by e-sourcing, e-markets and e-payments platforms as independent variables. Value chain management performance depicts the dependent variable. We discuss these relationships in subsequent sections leading to the hypotheses that explain the implications of procurement 4.0 on value chain management in the public sector.

Value Chain Management Performance

As indicated in previous sections, value chain management (VCM) is a strategic business approach that helps organisations increase their long-term competitiveness. Nevertheless, it is improbable that organisations would achieve this implied competitiveness if they were to operate within a fragmented would be achieved such competitiveness by operating as an individual business within a fragmented value chain. Procurement then works to link the value creation nodes throughout the entire value chain. Rather than focusing only on the day-to-day purchasing activities, procurement has to ensure that the long run value-adding activities are also uninterrupted (Maestrini et al., 2017; Nagy et al., 2018; Mutangili, 2019; Hassan et al., 2020). To that effect, studies (Walters et al., 2008; Maestrini et al., 2017; Khuan & Swee, 2018; Nicoletti, 2020b) connect value chain management performance with the effectiveness and efficiency of all value creation activities involved in meeting the end customer requirements. Moons et al., (2019) enthuse that this touches on product availability, on-time delivery, and order fill rate and storage

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capacity of the value chain to deliver that perform as expected. Accordingly, a set of metrics such as quality, flexibility, cost, supplier reliability, innovation, responsiveness, fill rate, and perfect order fulfilment decide value chain management performance. With this in mind, one can see the implications of procurement 4.0 given its platforms and performance objectives, as discussed in subsequent sections.

The Implication of E-Sourcing (E-Tendering) on Value Chain Management Performance

Oteki (2019) envisages an improvement in the efficiency of a tendering process by implementing an e-sourcing platform as part of the Procurement 4.0 application in organisations. Furthermore, Al-Yahya and Panuwatwanich (2018) established that the efficiency of an e-tendering system correlates with the time it takes to distribute and receive bids to and from suppliers. In their study, Khan et al., (2020) found that web-based e-sourcing systems led firms to reduced transaction costs, improved internal process efficiency and increased collaboration with the suppliers. Against this background, we can propose that:

H1: E-sourcing positively shapes the value chain management in South Africa's public sector organisations.

The Implication of E-Marketplaces on Value Chain Management Performance

E-Marketplaces function to seamlessly allow organisations to find new suppliers/buyers for the required products and cultivate cost-effective market networks for negotiating, settling and delivering the products and services efficiently (Raman & Jaiswal, 2014; Jelassi & Martínez-López, 2020; Sunmola & Shehu, 2020). For example, some studies Pala (2019); found firms to be more effective and efficient after implementing Business-to-Business (B2B) e-Marketplaces due to resulting interactions with their value chain partners. This finding suggests that strategic e-sourcing can help create value due to lowered cost, streamlined processes, and the development of new businesses for the implementing organisations. Accordingly, we propose that:

H2: E-Marketplaces (e-tendering) positively affect value chain management in South Africa's public sector organisations.

The Implication of E-Payments on Value Chain Management Performance

Cash-based procurement systems are vulnerable to losses through corruption and fraud. Several studies anticipate that e-payment platforms can reduce the risk of employees skimming funds from the organisation. Indian research (Muralidharan et al., 2016) established the value of e-payment by observing that leakage and fraudulent payments fell from 37 per cent to 18.5 per cent upon implementation of e-payment in a government department. Simultaneously, there is proof that immense cost savings are possible through e-payment implementation in manual processes of collecting, counting, recording and transporting cash. E-payment systems allow payments to be made instantaneously and at zero marginal costs. This finding leads to the assumption that:

H3: e-Payments have a favourable implication on value chain management performance in South Africa's public sector organisations.

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METHODOLOGY

This study followed a realist lens and cross-sectional survey research design. The basic idea in doing so was to limit researcher influence on the respondents and, in the process, extract an accurate, detailed, unembellished depiction of the implication of procurement 4.0 on value chain management. For Fels (2017), realism rejects imaginative idealisation in favour of close observation of outward appearances. In doing so, a single version of the truth about the phenomenon is possible. This approach favours the researcher to be detached from information collected by a standardised research questionnaire, thus minimising differing stories as there is no influence on the respondents. Questionnaires with closed-ended questions were employed for data collection. They were designed to cover essential characteristics of procurement 4.0 such that opinion on its implication on value chain management performance could be determined. The closed-ended questions were answered by selecting options from 1= "strongly disagree" to 7= "strongly agree."

Instrument Reliability and Validity

A pilot study was conducted with 50 respondents selected to gauge the reliability and validity of the questionnaire for the current research, and the following benchmarks were established in Tables 1 and 2, respectively.

TABLE 1
SUMMARY OF FINDINGS IN CRONBACH'S A RELIABILITY TEST ANALYSIS

Construct	No of Items	Mean	Item mean ranges	SD Range	Cronbach's α
e-Sourcing practices	13	3.99	3.78 - 4.64	1.042-1.175	0.713
e-Market systems	11	4.07	3.94-4.80	0.713-1.008	0.749
Implication of Procurement 4.0	21	4.86	4.11- 4.38	0.657-1.013	0.782

Source: Research data

As shown in Table 1, Cronbach's α coefficient value for the implication of procurement 4.0 on value chain management was 0.782. As per Saunders et al. (2009), this value exceeded the minimum threshold for instrument reliability confirmation for internal consistency of 0.70. This level implies that repeated use of the items measuring the implication of procurement 4.0 construct on value chain management performance would always yield consistent results.

Validity Testing

For this study, we assessed the instrument's construct validity through a statistical technique called factor analysis. The first task was establishing the factorability of items describing the procurement 4.0 construct. Table 2 reveals that KMO value exceeded the yardstick of 0.6, thus indicating that the sample was adequate for factor analysis on the dataset measuring the implication of procurement 4.0 on value chain management (Leech et al., 2014).

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TABLE 2 FACTORABILITY OF PROCUREMENT 4.0 CORRELATION MATRIX		
KMO and Bartlett's Test		
Kaiser-Meyer-Olkin Measure of Sampling adequacy		0.793
Bartlett's Test of Sphericity	Approx. Chi-Square	7057.791
	Dif	1138
	Sig.	0.000

Source: Pilot study survey data

Also, a significant p-value ($p < 0.03$) of Bartlett's Test of Sphericity, in Table 2, marked a factorable correlation matrix (Watkins, 2018). We the used Confirmatory factor analysis (CFA) to verify the construct validity of the instrument used to assess the implication of procurement 4.0 on value chain management in South Africa's public sector organisations. For Steward (2014), using CFA adds to statistical precision in assessing the testing instruments and thus assists in developing the research instrument or confirms its possible sub-domains. Table 3 shows the results of the CFA construct validity assessment.

TABLE 3 CFA CONSTRUCT VALIDITY ASSESSMENT OF PROCUREMENT 4.0 CONSTRUCTS					
	No. of Items	**Average loading**	**RAMSEA**	**TLI**	**CFI**
Procurement 4.0 practices	6	0.743	0.071	0.917	0.932
Procurement 4.0 systems	6	0.615	0.070	0.938	0.972
Value chain management implications	5	0.674	0.066	0.903	0.919

Source: Pilot study Survey data

The model fit statistics gives evidence of a good fit for the 3-factor model describing the implication of Procurement 4.0 in the South African public sector organisations since the CFI and TLI > 0.90 and the RMSEA < 0.1 (Brown, 2015; Kline, 2015; Saunders et al., 2009) and Table 3 also indicates that all items load significantly on each of the factors (p-values < 0.05). The CFA analysis thus confirmed the instrument's validity to measure the implication of procurement 4.0 on value chain management in South African public sector organisations.

Sample and Data Collection

We employed a non-probability (purposive) sampling technique to obtain a sample of 266 procurement and accounting officers from a target population of 257 municipalities and 21 municipal entities affiliated with the South African Local Government Association (SALGA), an autonomous association of South African local governments created to support member governments in fulfilling the developmental goals of the country. Table 4 show the profile of the respondents.

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TABLE 4
PROFILE OF PARTICIPANTS

Attribute	Frequency(*n*=266)	Percentage (%)
Age group (years)		
Below 30	87	32.7
30-39	79	29.7
40-49	64	24.1 13.5
50 and above	36	
Years of professional experience		
Below 5	23	8.6
5-10	97	36.5
10-15	68	25.6
15-20	34	12.8
Above 20	44	16.5
Education		
TVET College	63	23.7
Bachelor	178	66.9
Postgraduate (Masters)	19	7.1
Doctorate	6	2.3
Job level		
Employee level	86	32.3
Supervisory management level	102	38.3
Middle management level	61	23.0
Executive Level	17	6.4

Source: Survey data

Data Collection and Analysis

An online questionnaire was sent to SALGA for distribution to its members to determine the implication of Procurement 4.0 on value chain management in the public sector in South Africa. After a three month waiting period, 266 responses were received. The collected data were then statistically analysed using the Statistical Package for Social Sciences (SPSS) version 24.0. The respondents' demographic data and sample characteristics were analysed using descriptive statistics, frequencies, and percentages. Lastly, Pearson correlation analysis was applied to test the three hypotheses proposed in this study. Pearson r statistic gives an indication of how much and in what way two measured variables are related.

RESULTS

Respondents' perception on the procurement 4.0 leverage on value chain management is given in Table 5.

TABLE 5
RESPONDENTS' PERCEPTION ON THE PROCUREMENT 4.0 LEVERAGE ON VALUE CHAIN MANAGEMENT

Item	Mean	1	2	3	4	5	6	7	SD
Procurement 4.0 implication		Percentage (%)							
Procurement 4.0 provides a strategic interface to support organisational efficiency effectiveness, and profitability	4.01	3.3	4.1	16.5	33.1	28.6	9.1	5.3	1.001

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Procurement 4.0 streamlines the day –to – day operative processes thus improving value chain management decisions.	4.32	1.8	1.1	15.4	38.7	26.0	10.2	6.8	0.981
Procurement 4.0 many-to-many communication provides fast, open and accurate information thus improving accountability in the way financial resources are used.	4.67	1.1	1.1	17.8	41.3	28.2	5.25	5.25	0.994
Procurement 4.0 can be used as a strategic interface to achieve efficiency, effectiveness and profitability	4.21	0.8	1.5	13.2	43.6	28.2	9.8	3.0	1.023
Procurement 4.0's integrated user interfaces (for platforms and applications) enhances operational efficiency and effectiveness in the value chain	3.97	2.3	1.1	21.4	31.6	20.7	18.1	8.6	1.200
Procurement 4.0 minimises corruption, fraud and embezzlement and leakage of financial resources.	3.89	1.5	1.9	27.8	39.1	21.8	19.2	9.4	1.034
Procurement 4.0 guarantees a fair, just, competitive and cost effective purchasing and supply system	4.53	0	2.6	16.2	48.5	19.9	7.1	6.8	1.058
Procurement 4.0 enhances value chain transparency and traceability thus strengthening transactional relationships and trust levels in the value chain	4.11	0.03	1.1	17.3	45.5	18.4	11.3	6.0	1.104
The Centralised Supplier Database (CSD) has immensely reduced cost for both my organization and vendors	4.9	0.08	1.9	20.3	49.2	20.7	6.4	0.07	1.220
Internet-of-Things supports the creation of full transparency and accountability within the supply chain ecosystem	3.91	1.9	3.8	24.8	37.2	13.9	10.5	7.9	1.473
E-Marketplaces and E-Catalogue makes it much easier and quickly to search and find appropriate suppliers.	4.17	0.07	0.07	20.3	40.6	15.8	8.3	13.5	0.916
E-Invoicing and P-Card enable on time supplier payment (within 30 days of receipt of an invoice) and greatly reduce maverick(irregular) expenditure	4.09	0	0	12.0	63.5	11.7	7.1	5.6	1.301
Big Data within the organisational environment is easily collected, analysed, and processed within the procurement function thereby facilitating faster decision-making	5.03	0	0	11.7	67.3	10.9	4.9	5.3	1.162
Robotic Process Automation (RPA) frees up the time available to procurement professionals to engage in more value-added activities.	4.87	1.1	2.6	10.5	47.7	19.2	12.8	6.0	1.200
The use of Information and communication technologies in the organization calls for a new set of skill the procurement professionals	4.04	0	0	3.4	68.8	14.3	6.8	6.8	1.004
Through e-Procurement, speedily and accurate information is shared which	3.99	0	4.1	8.6	65.4	18.1	6.0	6.4	1.034

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inform supply chain decisions and because of the openness, accountability in the use of state funds is enhanced.									
The use of e-Procurement increases buyer's productivity as most of procurement and payment procedures are automated.	3.85	0	0	6.8	72.6	7.1	6.8	6.8	1.337

Source: Survey data

Hypothesis Testing

Pearson's correlation analysis was carried out to assess the implications of the various Procurement 4.0 practices in South Africa's public sector organisations' value chain management. The results presented in Tables 6, 7 and 8 were obtained.

H1: e-Sourcing positively shapes the value chain management in South Africa's public sector organisations.

TABLE 6
RELATIONSHIP BETWEEN E-SOURCING AND VALUE CHAIN MANAGEMENT

e-Sourcing practices	1
Quality service offering	0.532**
Improved supplier Relations	0.477**
Cost effective supplier selection	0.513**
Reduction in costs	0.410**
Improved compliance and risk reduction	0.333**
Achievement of established fill rates	0.408**
Perfect order fulfilment.	0.533**

** Significant at Alpha=0.01
Source: Survey data

Moderate ($0.3<|r|<0.5$), positive and statistically significant correlations were observed between e-sourcing practices and improved supplier relations ($|r|=0.477$), between e-sourcing practices and reduction in costs ($|r|=0.410$), between e-sourcing practices and improved compliance and risk reduction ($|r|=0.333$), between e-sourcing practices and achievement of the planned fill rates ($|r|=0.408$). Strong ($|r|>0.5$) statistically significant correlations were observed between e-sourcing practices and quality service offering ($|r|=0.532$), cost-effective supplier selection ($|r|=0.513$) and lastly, with perfect order fulfilment ($|r|=0.533$). These results unambiguously illustrate that e-Sourcing practices as part of Procurement 4.0 positively impact value chain management in South Africa's public sector organisations. Accordingly:

H1: e-Sourcing positively shapes the value chain management in South Africa's public sector organisations is accepted.

The results indicate that procurement 4.0 allows organisations to anticipate and detect likely disruptions such as supplier breakdowns and demand spikes and immediately act upon them before affecting the organisation. To that effect, procurement 4.0 guarantees improve efficiency and help organisations avoid some of the costs by providing visibility, planning, and execution, thus offsetting a devastating financial impact on the entire system. It improves cross-

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functional and integrates planning processes and value chain functions. This finding is consistent with various studies (Becker, 2018; Oteki, 2019; Khan et al., 2020) that found procurement 4.0 elements such as web-based e-sourcing systems reduced transaction costs, improved internal process efficiency and increased collaboration with the suppliers. These elements are critical to value chain management.

H2: E-Marketplaces (e-tendering) positively affect value chain management in South Africa's public sector organisations.

TABLE 7
RELATIONSHIP BETWEEN E-TENDERING AND VALUE CHAIN MANAGEMENT

e-Marketplaces (e-tendering) practices	1
Identification of Superior Quality Vendors	0.561**
Convenient to vendors making it an efficient process.	0.387**
Adherence to procurement rules and policies	0.408**
Deeper Data Insight thus proactive decision-making	0.481**
Higher procurement-generated cost savings	0.482**
Achievement of fair and transparent procurement processes	0.532**

**Significant at Alpha=0.01
Source: Survey data

In Table 7, moderate ($0.3<|r|<0.5$), positive and statistically significant correlations were observed between e-Markets (e-Tendering) practices and convenient to vendors making it an efficient process ($|r|=0.387$), adherence to procurement rules and policies ($|r|=0.408$), deeper data insight thus proactive decision-making ($|r|=0.481$), and higher procurement-generated cost savings ($|r|=0.482$). Strong ($|r|>0.5$) statistically significant correlations were found between e-Markets (e-Tendering) practices and the identification of superior quality vendors ($|r|=0.561$), and achievement of fair and transparent procurement processes ($|r|=0.532$). These results decidedly demonstrate that e-Markets (e-Tendering) practices as an element of Procurement 4.0 positively impact value chain management in South Africa's public sector organizations. Accordingly,

H2: E-Marketplaces (e-tendering) have a positive implication on value chain management in South Africa's public sector organisations is accepted.

These results cumulatively suggest that Procurement 4.0 takes out cost and increases speed and high-velocity decision-making, taking charge and increasing speed. Procurement 4.0 speeds up and improve insights and decisions across the supply chain. In today's increasingly turbulent global macroeconomic and political environment, it clear that organisations need to increasingly place a premium on flexibility and resiliency in their value chains (Govindan *et al*.,2015). It seems from the results that Procurement 4.0 is better placed to identify, in advance, a potential new supplier who is advantageous to organisations should unforeseen problems arise with existing supplies, thus mitigating supply risks and maintain productivity. Moreover, procurement 4.0 seems to have a higher capacity to connect the data across suppliers and other stakeholders in the value chain to enable transparency and collaboration and reduce frictional drag upon the value chain (Launio, 2019).

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H3: e-Payments have a positive implication on value chain management performance in South Africa's public sector organizations

TABLE 8
RELATIONSHIP BETWEEN E-PAYMENT PRACTICES AND VALUE CHAIN MANAGEMENT

e-Payment practices	1
Increased speed, convenient and efficient process.	0.566**
High transaction cost reduction	0.380**
Reduced costly human error, and/or fraud	0.449**
Suppliers get paid on time	0.553**
Make procurement easier and more cost effective	0.513**
Greater budgetary control and higher cost savings	0.329**
Ensure more secure and less risky for value chain companies	0.470**
Enables a simplified payments process and achievement of higher transaction volumes among the different value chain players	0.593**

** Significant at Alpha=0.01
Source: Survey Data

In Table 8, moderate ($0.3<|r|<0.5$), positive and statistically significant correlations were observed between **e**-Payment practices and high transaction costs reduction ($|r|=0.380$), Reduced costly human error, and fraud ($|r|=0.449$), Greater budgetary control and higher cost savings ($|r|=0.329$), and Ensure more secure and less risky for value chain companies ($|r|=0.470$). Strong ($|r|>0.5$) statistically significant correlations were found between **e**-Payment practices and Increased speed, convenient and efficient process ($|r|=0.566$), Suppliers get paid on time ($|r|=0.553$), Make procurement more manageable and more cost-effective ($|r|=0.513$ and Enables a simplified payments process and achievement of higher transaction volumes among the different value chain players ($|r|=0.593$). This combination of results decidedly demonstrates that e-Payment practices as part of Procurement 4.0 positively impact value chain management in South Africa's public sector organisations. As a result: As a result:

H3: e-Payments have a favourable implication on value chain management performance in South Africa's public sector organisations is is accepted.

These results point to some of the broad impacts on value chain management stemming from implementing procurement 4.0. Procurement 4.0 speeds up the value chain operations leading to shorter lead times, reliability, responsiveness and agility. These are the critical capabilities needed by any organisation to create and deliver value. Modern-day value chain management needs to be fast, intelligent, and procurement 4.0 speeds up and improve insights and decisions across the supply chain (Bienhaus & Haddud, 2018; Hassan et al., 2020).

CONCLUSION

The complex South African public sector analysis indicates that procurement 4.0 has several implications on value chain management, thus demanding a paradigm shift in managing the public entities in the present epoch of the fourth industrial revolution (industry 4.0). Procurement 4.0 positively impacts value chain management in public sector organisations

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through its effects on efficiency, total costs, agility, flexibility, resiliency, value creation and delivery, thereby contributing to the social and economic welfare of the citizens and businesses. Moreover, procurement 4.0's ability to connect the data across suppliers and other stakeholders' value chain brings transparency and collaboration, thereby reducing frictional drag upon the value chain management performance. As such full implementation of procurement 4.0 can increase the effectiveness, efficiency, transparency and accountability of value chain management in public sector organisations in South Africa. Implementation of procurement 4.0 also requires training to equip employees and managers with new skills to implement procurement 4.0 in value chain management processes. Nevertheless, the findings of this study are only applicable to the local government, not the entire South African public sector. Future studies could more systematically analyse the relationships among procurement 4.0 include the national government departments and state-owned enterprises, to give a complete insight into the implication of 4.0 on the public sector value chain management.

REFERENCES

Aboelmaged, M. G. (2014). Predicting e-readiness at firm-level: An analysis of technological, organizational and environmental (TOE) effects on e-maintenance readiness in manufacturing firms. *International Journal of Information Management*, *34*(5), 639-651.

Al-Yahya, M., & Panuwatwanich, K. (2018). Implementing e-tendering to improve the efficiency of public construction contract in Saudi Arabia. *International Journal of Procurement Management*, *11*(3), 267-294.

Becker, J. (2018). *Systems and E-Procurement-Improving Access and Transparency of Public Procurement*. Brussels, Belgium.

Bienhaus, F., & Haddud, A. (2018). Procurement 4.0: factors influencing the digitisation of procurement and supply chains. *Business Process Management Journal*, *24*(2), 965-984.

Brown, T. A. (2015). *Confirmatory factor analysis for applied research*. Guilford publications.

Deshmukh, S. U. (2020). Impact of E-Business on Business Association. *International Journal of Engineering and Management Research*, *9*(6), 7-12.

Fels, E. (2017). Theoretical Framework: Realism as a Lens for Analysis. In *Shifting Power in Asia-Pacific?* pp. 85-152. Springer, Cham.

Fourie, D., & Malan, C. (2020). Public Procurement in the South African Economy: Addressing the Systemic Issues. *Sustainability*, *12*(20), 8692.

Glas, A. H., & Kleemann, F. C. (2016). The impact of industry 4.0 on procurement and supply management: A conceptual and qualitative analysis. *International Journal of Business and Management Invention*, *5*(6), 55-66.

Govindan, K., Azevedo, S.G., Carvalho, H., & Cruz-Machado, V. (2015). Lean, green and resilient practices influence on supply chain performance: interpretive structural modeling approach. *International Journal of Environmental Science and Technology*, *12*(1), 15-34.

Hassan, M. A., Shukur, Z., & Hasan, M. K. (2020). An Efficient Secure Electronic Payment System for E-Commerce. *Computers*, *9*(3), 66.

Heppelmann, J., & Porter, M. (2014). How the Internet of Things could transform the value chain? *McKinsey & Company Interview. Retrieved from: http://www.mckinsey.com/industries/high-tech/our-insights/how-theinternet-of-things-could-transform-the-value-chain*

Jelassi, T., & Martínez-López, F. J. (2020). Interaction with Suppliers: e-Procurement. In *Strategies for e-Business* pp. 275-305. Springer, Cham.

Kache, F., & Seuring, S. (2017). Challenges and opportunities of digital information at the intersection of Big Data Analytics and supply chain management. *International Journal of Operations & Production Management, 37*(1), 10-36.

Khan, U., Asim, M., & Manzoor, S. (2020). Improving supply chain management of a distribution firm using ERP System. *European Journal of Business and Management Research, 5*(2), 1-10.

Citation Information: 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.

Khuan, L. S., & Swee, M. F. S. H. (2018). Technologies for Procurement: Current Trends and Emerging Trends. *Emerging Technologies for Supply Chain Management*, *4*, 45-61.

Kline, R. B. (2015). *Principles and practice of structural equation modeling*. Guilford publications.

Launio, E. (2019). *Digitalization & Transactional Information Flow Analysis of a Pulp Supply Chain*. Bachelor's thesis, JAMK University of Applied Sciences, Finland.

Leech, N. L., Barrett, K. C., & Morgan, G. A. (2014). *IBM SPSS for intermediate statistics: Use and interpretation*. Routledge.

Mackey, T. K., & Cuomo, R. E. (2020). An interdisciplinary review of digital technologies to facilitate anti-corruption, transparency and accountability in medicines procurement. *Global health action*, *13*(sup1), 1695241.

Maestrini, V., Luzzini, D., Maccarrone, P., & Caniato, F. (2017). Supply chain performance measurement systems: A systematic review and research agenda. *International Journal of Production Economics*, *183*, 299-315.

Meehan, J., Menzies, L., & Michaelides, R. (2017). The long shadow of public policy; Barriers to a value-based approach in healthcare procurement. *Journal of Purchasing and Supply Management*, *23*(4), 229-241.

Moons, K., Waeyenbergh, G., & Pintelon, L. (2019). Measuring the logistics performance of internal hospital supply chains–a literature study. *Omega*, *82*, 205-217.

Muralidharan, K., Niehaus, P., & Sukhtankar, S. (2016). Building state capacity: Evidence from biometric smartcards in India. *American Economic Review*, *106*(10), 2895-2929.

Mutangili, S. K. (2019). Influence of E-Procurement Practices on Supply Chain Performance: A Case Study of Kenya Airways. *Journal of Procurement & Supply Chain*, *3*(2), 1-16.

Nagy, J., Oláh, J., Erdei, E., Máté, D., & Popp, J. (2018). The role and impact of Industry 4.0 and the internet of things on the business strategy of the value chain-the case of Hungary. *Sustainability*, *10*(10), 3491.

Nicoletti, B. (2018). The future: procurement 4.0. In *Agile procurement* (pp. 189-230). Palgrave Macmillan, Cham.

Nicoletti, B. (2020a) Industry 4.0 and Procurement 4.0. In: *Procurement 4.0 and the Fourth Industrial Revolution*. Palgrave Macmillan, Cham.

Nicoletti, B. (2020b). Platforms for Procurement 4.0. In *Procurement 4.0 and the Fourth Industrial Revolution* pp. 117-189, Palgrave Macmillan, Cham.

Oteki, E. B. (2019). *Influence of Electronic Procurement Practices on Supply Chain Performance of Sugar Processing Firms in Kenya.* Doctoral dissertation, JKUAT-COHRED.

Paesbrugghe, B., Rangarajan, D., Sharma, A., Syam, N., & Jha, S. (2017). Purchasing-driven sales: Matching sales strategies to the evolution of the purchasing function. *Industrial Marketing Management*, *62*, 171-184.

PALA, M. (2019). Post-implementation analysis of a B2B e-marketplace. *ITcon*, *24*, 129-153.

Porter, M. E. (1998). *Clusters and the new economics of competition.* Boston: Harvard Business Review, *76*(6), 77-90).

Raman, A., & Jaiswal, M. P. (2014). SAP Labs India: co-innovation in public procurement system. *Emerald Emerging Markets Case Studies*, *4*(3), 0200.

Rejeb, A., Keogh, J. G., & Treiblmaier, H. (2019). Leveraging the internet of things and blockchain technology in supply chain management. *Future Internet*, *11*(7), 161.

Rotich, G. K., & Okello, B. (2015). Analysis of use of e-procurement on performance of the procurement functions of county governments in Kenya. *International Journal of Economics, Commerce and Management*, *3*(6), 1381-1398.

Saunders, M., Lewis, F., Tornhill, A. (2009). *Research Methods for business students*. Pearson publications.

Shale, N. I., Guyo, W., & Amuhaya, I. M. (2015). *Role of e-procurement strategy on the performance of state corporations in Kenya. International Journal of Science and Research (IJSR)*, *2*(11), 421-426.

Soosay, C., & Kannusamy, R. (2018). Scope for industry 4.0 in agri-food supply chain. In *The Road to a Digitalized Supply Chain Management: Smart and Digital Solutions for Supply Chain Management. Proceedings of the Hamburg International Conference of Logistics (HICL)*, *25*, 37-56.

Steward, J. L. (2014). *Development and testing of the Primary Care Homeless Organizational Assessment Tool (PC-HOAT) to evaluate primary care services for the homeless*. The University of Alabama at Birmingham.

Sunmola, F. T., & Shehu, Y. U. (2020). A Case Study on Performance Features of Electronic Tendering Systems. *Procedia Manufacturing*, *51*, 1586-1591.

Van Weele, A. J. (2018). *Purchasing and supply chain management*, 7th Edition, Cengage Learning, Andover.

Citation Information: 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.

Walters, D., Glaser, S., & Barber, E. (2008). How to measure the "value" in value chains? *International Journal of Physical Distribution & Logistics Management, 38*(9), 685-698.

Watkins, M. W. (2018). Exploratory factor analysis: A guide to best practice. *Journal of Black Psychology*, *44*(3), 219-246.

Williams, O. K. O. T. I. E., & Ehiabhi, T. A. F. A. M. E. L. (2021). Transparency and public procurement practices in the Nigerian Civil Service. *African Journal of Business Management*, *15*(1), 41-48.

Zhang, M., Guo, H., Huo, B., Zhao, X., & Huang, J. (2019). Linking supply chain quality integration with mass customization and product modularity. *International Journal of Production Economics*, *207*, 227-235.

Citation Information: 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.