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Effect of e-procurement on Supply Chain Performance of Level 6 Hospitals in Kenya: A Case Study of Kenyatta National Hospital

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Abstract:

The study aimed to elucidate the relationship between e-procurement and supply chain performance, offering an empirically grounded framework. It focused on assessing e-procurement's impact on supply chain performance in Kenya's level six hospitals, specifically analyzing the effects of e-tendering, e-invoicing, and e-payment within these institutions. The theoretical framework was based on Rogers' diffusion of innovation theory, transaction cost economics theory, and dynamic capability theory. A descriptive research design was employed, targeting 143 employees from the finance and procurement departments of Kenyatta National Hospital. Data were collected using structured questionnaires and analyzed with SPSS version 26, employing both descriptive and inferential statistics to derive findings and conclusions regarding the study variables. The results indicated that e-tendering ($\beta= 0.328$; $t= 4.739$; $p= 0.000$), e-invoicing ($\beta= 0.239$; $t= 2.005$; $p= 0.000$), and e-payment ($\beta= 0.416$; $t= 1.901$; $p= 0.02$) had a statistically significant positive impact on supply chain performance. With an overall p-value of 0.000 and an adjusted coefficient of determination of 75.6%, the study confirmed that e-procurement significantly affects supply chain performance in level six hospitals. The findings conclude that e-procurement practices positively and significantly enhance the supply chain performance of level six hospitals in Kenya. The study recommends broadly adopting e-procurement practices, including e-tendering, supplier assessment, e-invoicing, and e-payments, to enhance supply chain performance in Kenya's level six hospitals. Further research is suggested on the impact of e-procurement on supply chain performance in other government institutions, such as public universities.

Keywords: e-procurement, supply chain performance, e-tendering, e-invoicing, e-payment

1. Introduction

1.1. Background Information

Effective supply chains are essential for firms to remain competitive in today's global market (Namusonge, 2017). Effectiveness is achieved through synchronizing and coordinating supply chain activities from end-customers to suppliers (Masudin et al., 2021). Thus, procurement, shaping an organization's supplier relationships, becomes crucial (Eugenie & De Dieu, 2022). Globally, e-procurement practices are essential in supply chain management. In Brazil, Edquist et al. (2016) indicate that e-procurement can achieve real savings. Similarly, Shahin et al. (2022) noted that in Malaysia, e-procurement has enhanced competitive tendering, reducing corruption by an estimated 5.9%, compared to 3.7% with traditional paperwork.

Consequently, E-procurement is a developing trend in the public sector and is the foundation of global e-government projects. Many governments from across the world have started e-procurement efforts at the national or municipal level in recent years. The NASA Acquisition Internet Service in the United States was the first e-procurement program to be established in the public sector. At prod.nais.nasa.gov, NASA posted first-time bids for between \$25,000 and \$500,000 (Wu & Chien, 2016). Chile, Guatemala, India, Italy, Panama, Philippines, Romania, South Korea, and Thailand are now regarded as having the most sophisticated and effective public e-procurement systems at the national level.

Service delivery quality to residents, especially marginalized groups, has improved across Africa due to governments maximizing budget purchasing power and enhancing procurement capabilities. Competitive and transparent public procurement systems are essential for sustainable development and prosperity in marginalized African communities. In Ghana, e-procurement addresses core issues affecting hospital performance, such as limited public and civil society information access. South Africa's Preferential Procurement Policy Framework Act 5 of 2000 establishes a fair public procurement policy framework, fulfilling section 217(3) of the 1996 Constitution. This framework aims to enhance procurement practices and outcomes, ensuring equitable access and efficiency.

Chegugu and Yusuf (2017) argue that ICT advancements have driven companies to transition from traditional operations to e-business, e-procurement, and e-supply Chain models. They emphasize the necessity of real-time information on demand fluctuations to maintain accurate replenishment schedules and inventory levels in the

manufacturing process. In Kenya, e-procurement is still in its infancy. The country is overhauling public procurement by implementing several reforms to enhance efficiency. Key reforms include the introduction of e-procurement processes. Waganda (2018) reported that Kenya has adopted e-procurement practices such as online advertisement of tenders, receiving online submissions of proposals, and short-listing suppliers online.

Reforms aimed at introducing high-speed, high-capacity fibre optic cables to enhance internet efficiency and enable e-procurement were implemented (ROK, 2019). The Integrated Financial Management Information System (IFMIS) was also introduced to support e-procurement and improve governance in Ministries and Departments (Kioko & Mwangangi, 2017). The Kenyan government considers ICT a key pillar in Vision 2030, aiming to industrialize the nation by 2030. Despite e-procurement being a medium-term objective slated for implementation by June 2007, its adoption among state corporations has been alarmingly slow (Ngeno & Kinoti, 2017).

Further, recent research has shown a clear shift from the traditional forms towards digital methods that have enabled efficiency and versatility in the supply chain performance (Chegugu & Yusuf, 2017). The inclusion of electronic practices in the procurement departments has reduced cases of corruption since the level of transparency has been raised. E-tendering has enabled suppliers to track their tenders and the entire process until the tenders are awarded. However, there have been some loopholes in the processes where corruption has been linked. In addition, inefficiencies relating to inaccurate invoicing, payment, and delays in the delivery of critical medical requirements have been reported at the six hospitals at various levels in Kenya. Additionally, there is limited research on e-procurement's impact on supply chain management performance in Kenya's level six hospitals. This study, therefore, aimed to examine e-procurement's effect on SCM performance at Kenyatta National Hospital.

1.2. Problem Statement

Recent studies have shown a clear shift from traditional forms towards digital methods that have enabled efficiency and versatility in the supply chain performance (Chegugu & Yusuf, 2017). Significant initiatives, such as the deployment of high-speed fibre optic cable to enhance internet efficiency, were undertaken to enable e-procurement (ROK, 2009). Moreover, the Integrated Financial Management Information System (IFMIS) was introduced to strengthen e-procurement and enhance governance in Ministries and Departments (Barasa & Namusonge, 2017). Kenya regards ICT as pivotal in realizing Vision 2030's goal of industrializing the nation by 2030. Despite e-procurement being a medium-term objective set for completion by June 2007, its adoption among state corporations has been notably slow (Ngeno & Kinoti, 2017). In both the private and public sectors in Kenya, data suggest that e-procurement implementation is progressing sluggishly (Barasa & Namusonge, 2017). Further, inefficiencies relating to inaccurate invoicing, payment, and delays in the delivery of critical medical requirements have been reported at the six hospitals at various levels in Kenya. According to Patrick (2010), an examination of systems, policies, and procedures at Kenyatta National Hospital (KNH) unearthed loopholes for unethical practices and recommended sealing the loopholes and weaknesses in operational areas within KNH. The objective is to enhance supply chain performance at the facility by improving service delivery, reducing cycle time, and minimizing complaints. Given the insufficient research on e-procurement's impact on supply chain management in Kenya's level six hospitals, this study investigates its effect at Kenyatta National Hospital.

1.3. Research Hypothesis

- H₀₁: E-procurement has no significant effect on supply chain performance in Kenya's level 6 hospitals.

2. Literature Review

2.1. Theoretical Framework

The study utilizes Rogers' Diffusion of Innovation Theory, Transaction Cost Economics Theory, and Dynamic Capability Theory as its primary frameworks.

2.2. Rogers' Diffusion of Innovations Theory

The adoption of new innovations has been extensively studied for over three decades, with Rogers' "Diffusion of Innovations" being a prominent model (Sherry & Gibson, 2002). This model is widely utilized across disciplines such as political science, public health, communications, history, economics, technology, and education (Dooley, 1999; Stuart, 2000). Rogers' theory serves as a prevalent framework for studying technology diffusion and adoption, particularly in higher education and educational settings.

Diffusion research often treats "technology" and "innovation" as interchangeable terms (Rogers, 2003). Rogers defines technology as a design for action that reduces uncertainty in achieving desired outcomes, encompassing both hardware and software. Hardware represents the technology as a physical entity, while software constitutes its informational aspect. The adoption of software as a technological innovation tends to progress slowly due to its limited observability. This perspective highlights the intricate interplay between technological design, uncertainty reduction, and adoption pace within the diffusion of innovations framework.

Rogers (2003) delineates the Diffusion of Innovations model, encompassing adoption, where individuals fully embrace innovation, and rejection, where they decline adoption. Diffusion entails the communication of innovation through particular channels over time within a social system. This definition underscores innovation, communication channels, time, and social systems as the four pivotal elements of the diffusion process within the framework of the Diffusion of Innovations theory.

Rogers (2003) characterizes innovation as an idea, practice, or project perceived as novel by individuals or adopter groups. Perceived novelty determines an innovation's classification, irrespective of its prior existence. The notion of newness aligns closely with the stages of the innovation-decision process—knowledge, persuasion, and decision—which will be addressed subsequently. Rogers highlights a research gap in technology clusters within diffusion studies, defining them as closely interconnected technological elements. This underscores the intricacy of innovation perception and diffusion dynamics within technological environments.

Uncertainty presents a significant barrier to innovation adoption. Consequences, defined as changes stemming from the adoption or rejection of an innovation (Rogers, 2003), can exacerbate uncertainty. To mitigate uncertainty, individuals require comprehensive information on the innovation's pros and cons, enabling them to anticipate its outcomes fully. Rogers further categorizes consequences as desirable or undesirable (functional or dysfunctional), direct or indirect (immediate or resulting from immediate effects), and anticipated or unanticipated (intended or unintended). This classification underscores the multifaceted nature of consequences and their role in shaping individuals' perceptions and decisions regarding innovation adoption.

2.3. Innovation-Decision Process

Rogers (2003) outlines the innovation-decision process as an information-seeking endeavor to mitigate uncertainty regarding an innovation's merits and drawbacks. This process involves five sequential steps: knowledge, persuasion, decision, implementation, and confirmation, usually unfolding in chronological sequence, as illustrated in figure 1.

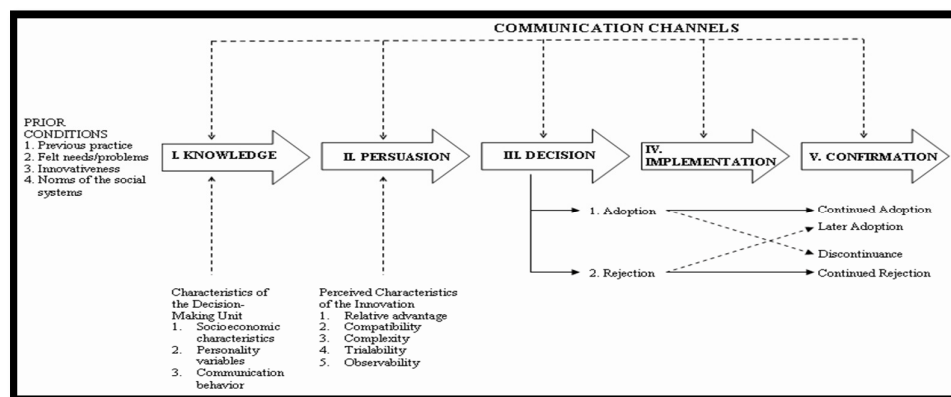


Figure 1: A Model of Five Strategies in the Innovation Decision Process

2.4. Transaction Cost Economics Theory

Transaction Cost Economics (TCE) seeks to elucidate the existence, expansion, and outsourcing decisions of firms. Ronald Coase introduced the TCE theory in 1937, pioneering the theoretical definition of firms vis-à-vis markets. The theory regards firms as governance structures rather than production functions (Williamson, 1985). The theory concentrates on the relative efficiency of different exchange processes within a firm. As a production function, the internalization of one or more stages of production is likely to generate technological economies of scale. As a governance structure, it could also lead to transactional economies when reduced amounts of resources are required to get the intermediate inputs. Transaction costs could be defined as the costs of acquiring and handling information about the quality of inputs, the relevant prices, the supplier's reputation, and so on.

Transaction Cost Economics theory has been criticized by Eric and Fares (2000) and Foss and Klein (2005) for assuming that individual productive capabilities and amenities are unchanged by any transition from one mode to another. This omission leads to a neglect of context-specific processes of individual transformation, development and learning and an overly narrow focus on presumed invariant human attributes such as opportunism (Hodgson, 2009).

2.4.1. Dynamic Capability Theory

The aspect of dynamic capability was first coined by David Teece, Gary Pisano and Amy Shuen (Chien & Tsai, 2012). The theory describes a business's aptitude to organize its assets in an effort to improve performance deliberately. According to Chien and Tsai (2012), the dynamic capability is the aptitude of firms and other institutions to adjust their resource base purposefully. An organization should be able to respond satisfactorily and appropriately to a wide variety of external factors. This requires the adoption of different strategies that will harness multiple capabilities of the organization and put them into use. This will give the company the ability to integrate, develop, and leverage the environmental competitive advantage. Indeed, the current business world is very dynamic. Changes ranging from organizational structures, culture, marketing and customers' tastes and preferences are taking a different path. For that matter, firms should have the capability to act in response to these changes in the most effective manner. The dynamic capability theory asserts that only those organizations able to achieve this will actually be able to break even in this competitive world (Chien & Tsai, 2012).

Dexterity is a factor that organizations cannot ignore, given that it is a business-wide aptitude that holds organizational composition, logistics processes, data structures, and mindsets (Christopher, 2000). Scholars argue that the

objective of the agility of supply chains is to ensure firms have the capability to respond speedily to immediate adjustments in either demand or supply. Moreover, it helps to ensure that organizations develop the capacity to handle external disruptions effortlessly (Lee, 2004). Other scholars have also identified other aspects of the agile supply chain. According to Christopher (2000), these elements include sensitivity, virtuosity, network-based, and process integration. The latter refers to the act of mutual operational among all stakeholders, shared information, and cooperative product expansion.

Organizations need a responsive supply chain because it is highly market-susceptible. When they use it, their firms have the capacity to evaluate and react to the demands of the market appropriately. For the supply chain to make the most impact, the members need to show the willingness to create an appropriate environment in which information flows freely in all directions. Christopher (2000) expounds on this concept by stating that firms need to reduce lead time to be able to leverage supplier relations and eventually create agile supply chains. Through the leverage of the respective competencies of network partners, they are able to realize greater receptiveness to the various market needs. According to Krajewski et al. (2009), efficient supply chains have the aptitude of make-to-stock, low inventory investment, and low capacity cushion. They also have the qualities to make short lead-time, timely delivery, and emphasise low process.

This theory is related to e-order processing, which aims to cope and change with dynamic markets to provide goods and services to sugar processing companies to use in their production process in a highly dynamic and competitive environment. Changes in marketing strategy, organizational structure, and tastes and preferences among customers are prevalent, and as such, sugar firms should be able to process customers' orders quickly. Evidently, e-procurement integrates the in-house and external procurement components to address dynamics in how organizations achieve operational excellence by reducing cost and saving time to procure goods (Mwenga, 2016). Additionally, e-procurement is IT-based and will almost always be up to date with the latest trends in the market.

2.4.4. Empirical Review

E-procurement is a broad term that involves many things, from internet shopping to collaborative initiatives used in virtual meetings. According to Pattanayak and Punyatoya (2020), e-procurement consists of purchasing solutions based on technology that simplifies transactions between and within the organizations and IT solutions for logistics, ordering and handling systems, and payment systems. Some of the E-procurement systems assessed include e-tendering, e-invoicing, and e-payment. Al-Yahya and Panuwatwanich (2018) claim that a company that implements e-procurement benefits from the following: Initially, there will be a reduction in costs during the tendering process as electronic transmission eliminates postage, paperwork, and preparation expenses. Additionally, electronic submission accelerates document delivery compared to traditional mail. It enhances order tracking and facilitates timely rectification of errors in previous orders, thereby improving overall efficiency. Second, there is a reduction in the amount of time it takes to find materials.

Knudsen (2013) asserts that e-procurement is swift, efficient, and effective for discovering and engaging new sources. It serves as a streamlined avenue for information exchange and swiftly connects with and identifies new suppliers.

Supply chain performance, as defined by Faheem and Siddiqui (2020), assesses the alignment of production and transportation activities with end-customer demands, including product availability and timely delivery. It encompasses tangible and intangible production factors, providing a comprehensive evaluation of supply chain management effectiveness. Supply chain achievement measurement is another vital concept in the procurement industry that stakeholders use to refer to the process of determining the productivity of the supply chains. Supply Chain performance has five attributes (Supply Chain Council, 2010). These elements are reliability, SC costs, SC asset management, SC responsiveness, and SC flexibility. Supply chain performance represents extended supply chain activities to meet customers' tastes and preferences at the tail end of service or good provision. This concept takes into account product availability, on-time delivery, and all relevant portfolios of customer satisfaction.

E-procurement practices are crucial in global supply chain management. Transitioning from traditional to digital methods enhances efficiency and flexibility in supply chain performance (Chegugu & Yusuf, 2017). The inclusion of electronic practices in the procurement departments has reduced cases of corruption since the level of transparency has been raised. E-tendering has enabled suppliers to track their tenders and the entire process until the award of tenders. Silvester (2020) investigated e-procurement practices' impact on public hospitals' performance in Tanzania, focusing on e-sourcing, e-informing, and e-tendering. The study examined how these practices influenced procurement performance within the hospitals.

3. Methodology

This research employed a descriptive survey design, focusing on Kenyan level 6 hospitals, specifically Kenyatta National Hospital level 6. The study aimed to generate both quantitative and qualitative data, utilizing correlation statistics and multiple regressions for analysis. Both qualitative and quantitative data were incorporated into the study's analysis methodology.

The study targeted 143 Kenyatta National Hospital employees for research. The study's target personnel in the procurement and finance department were a population of 143 employees. The study respondents were procurement officers, heads of departments, procurement assistants, internal auditors and accountants.

The set of components from which the sample is actually obtained is known as a sampling frame (Kothari, 2008). The study targeted all 143 employees of Kenyatta National Hospital since the population was too small. The list of

procurement officials and employees in the procurement and finance departments served as the sampling frame. According to Singh and Masuku (2014), census sampling is used when the population is small.

Semi-structured questionnaires were used to collect the study's primary data. A questionnaire was employed since it is cost-effective in terms of time, energy, and money. Similarly, it produces quantifiable data that is simple to acquire (Nayak & Singh, 2021). Respondents were expected to fill in the blanks and provide accurate information willingly. Secondary data were obtained from peer-reviewed articles and previous research done concerning e-procurement activities.

Quantitative data were evaluated using descriptive statistics, such as frequency and percentage tables, to interpret the respondents' perceptions of issues mentioned in the questionnaires to respond to the research questions. To figure out how e-procurement practices affect supply chain performance, regression analysis was used. The following regression model was used:

$$Y = \beta_0 + \beta_1X_1 + \beta_2X_2 + \beta_3X_3 + e$$

Where:

Y= supply chain Performance,

β_0 = (alpha) constant

Coefficients of respective e-procurement practice:

X_1 = e-invoicing

X_2 = e-tendering

X_3 = e-payment

e = error

4. Results and Discussions

4.1. Regression Analysis

Regression analysis determined e-procurement's influence on supply chain performance in Kenya's level 6 hospitals, using Kenyatta National Hospital as a case study. The null hypothesis states:

- H01: There is no significant effect of e-procurement on supply chain performance in level 6 hospitals in Kenya.

Table 1 shows an R Square of 0.873, indicating that 87.3% of supply chain performance variations are explained by e-procurement.

Model	R	R Square	Adjusted R Square	Estimated Std. Dev. Error
1	.873 ^a	.762	.756	1.46276

Table 1: Model Summary of e-Procurement and Supply Chain

a. Predictors: (Constant), e-procurement

Source: Research Data (2023)

Table 2 demonstrates the model's suitability for assessing the e-procurement and supply chain performance relationship, showing a significant f-calculated value of 11.614 ($p = 0.000 < 0.05$). This confirms the regression model's statistical adequacy in predicting the relationship.

	Sum of Squares	df	Mean Square	F	Sig.
Regression	67.875	7	17.072	11.614	.000 ^b
Residual	15.902	122	1.470		
Total	83.777	129			

Table 2: ANOVA Test

b. Predictors: (Constant), e-procurement

Source: Research Data (2023)

The examination of coefficients in table 2 revealed that the variables E-tendering, E-invoicing, and E-payment significantly forecasted Kenyatta National Hospital's (KNH) supply chain performance. E-tendering notably and positively impacted level 6 hospitals' supply chain performance, with a coefficient of 0.328 and a t-value of 4.739 ($p=0.000$). This indicates that a one-unit increase in e-tendering leads to a significant 0.328 increase in KNH's supply chain performance. Similarly, e-invoicing demonstrated a notable positive effect on KNH's supply chain performance, with a coefficient of 0.239 and a t-value of 2.005 ($p=0.000$), establishing a significant relationship. E-payment displayed a positive and significant correlation with KNH's supply chain performance, with a coefficient of 0.416 and a t-value of 1.901 ($p=0.020$). Overall, all variables demonstrated a positive and significant association with the hospital's supply chain performance, underscoring their predictive and enhancing role in KNH's supply chain efficiency.

Hence, the multiple regression model equation is accredited as shown below:

The equation was:

$$Y = \beta_0 + \beta_1X_1 + \beta_2X_2 + \beta_3X_3 + e.$$

Therefore:

$$Y = 1.507 + 0.328X_1 + 0.239X_2 + 0.416X_3 + \dots$$

Where:

Y= supply chain Performance,

β_0 = constant or intercept.

Coefficients of respective e-procurement practice:

X_1 = e-invoicing

X_2 = e-tendering

X_3 = e-payment

Model	Unstandardized Coefficients	Standardized Coefficients		t	Sig.
	B	Std. error	Beta		
Constant	1.507	.852		3.640	.000
E-tendering	.328	.127	.371	4.739	.000
E-invoicing	.239	.054	.702	2.005	.000
E-payment	.416	.269	.076	1.901	.020

Table 3: Multiple Regression Coefficient
a. Dependent Variable: Supply Chain Performance
Source: Research Data (2023)

The results for null hypotheses are provided in table 4 below.

Hypothesis	p-value	Decision
H₀₁ : There is no significant effect of e-procurement on supply chain performance in level 6 hospitals.	$p=0.000 < 0.05$	Reject H₀₁

Table 4: The Results for Null Hypotheses

4.2. Key Findings

This study corroborates Waganda's (2018) research on the influence of e-procurement on United Nations agencies in Nairobi, revealing a connection between e-invoicing, e-tendering, e-payment, and procurement efficiency. It suggests a positive and significant impact of e-procurement on supply chain performance in Kenyan level 6 hospitals. This consensus resonates with Kilay et al.'s (2022) discovery of e-commerce and e-payment's positive influence on supply chain performance in Indonesian SMEs.

The study confirmed e-procurement's favorable effect on county government performance, consistent with Otieno et al.'s (2021) discovery of a positive correlation between e-tendering and supply chain performance in county government. Additionally, Chegugu and Yusuf (2017) demonstrated the competitive advantage of e-tendering in public hospital performance. Gathima & Njoroge's (2018) study on e-tendering's impact on public sector organizational performance further corroborated these results.

5. Conclusions and Recommendations

The results reveal a meaningful and substantial association between specific e-procurement practices and supply chain performance in Kenyan level 6 hospitals. Particularly, e-tendering demonstrated a significant positive impact on supply chain performance. Strengthening e-tendering processes and infrastructure can directly enhance supply chain performance. Implementing and upholding online contract management systems, conducting regular online evaluations, posting tenders online, managing online bidding records, and screening and selecting suppliers online significantly enhance supply chain performance.

The study found a significant correlation between e-invoicing and supply chain performance in Kenyan level 6 hospitals. Enhancing e-invoicing practices directly impacts supply chain performance. Implementing invoice templates, online invoice processing, invoice software, automatic payment reminders, and online payment notifications significantly improve supply chain performance in these hospitals.

The study indicates a significant and positive relationship between e-payment and supply chain performance in Kenyan level 6 hospitals. Improving e-payment methods and systems directly influences supply chain performance. Continuous online interaction with suppliers' accounts, utilizing online banking systems, adopting mobile-based payments, accepting credit and debit cards, and permitting smartcard usage by suppliers notably enhance supply chain performance within these hospitals.

The study recommends that the hospital management and tender committee teams should routinely conduct supplier assessments to ensure the best suppliers are approved. An online system is recommended to monitor the tenders, process and publish them on time. Monitoring the tenders online eases the burden of re-advertising and duplicating tenders.

Another recommendation concerns the adoption of invoice templates to facilitate invoice issuing in the hospital. Invoice software should be installed in hospital systems to increase the speed of operations and save on costs. The hospitals should implement and embrace online payment methods, especially during this COVID-19 period. The use of online payment improves operations and enhances security.

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