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The role of supply market intelligence in service innovation and supply chain performance: evidence from the health services industry in Ghana

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Abstract

Purpose – This study aims to investigate the significance of supply market intelligence (SMI) in enhancing service innovation and supply chain performance within the health services industry of developing countries, focusing specifically on Ghana.

Design/methodology/approach – Using a quantitative approach, data are collected from teaching and regional hospitals in Ghana. The research examines the relationship between SMI, service innovation and supply chain performance. Partial least squares structural equation modelling (PLS-SEM) is employed for data analysis.

Findings – The study highlights the importance of adopting service innovation in healthcare delivery, supported by insights from SMI and efficient supply chains. The results underscore the positive impact of SMI on service innovation and supply chain performance in the context of health service delivery.

Originality/value – This study contributes to the existing literature by addressing the gap in exploring the relationship between SMI, service innovation and supply chain performance in the services sector, particularly within the health services industry of developing countries like Ghana. It employs resource dependence theory (RDT) to understand the impact of SMI on service innovation and supply chain performance in healthcare delivery. The findings provide valuable guidance for healthcare providers, policymakers and practitioners in integrating these concepts to enhance the quality of health services and improve patient satisfaction.

Keywords Supply chain performance, Supply market intelligence, Service innovation, Health services industry

Paper type Research paper

1. Introduction and background

With increased rivalry and growing industry needs, enterprises are pressured to develop innovative goods and services to suit market needs (Yam and Chan, 2015). Today, supply chains (SC) are perceived as an origin of competition over rivals. As a result, business-to-business marketing and manufacturing now prioritise research on SC innovation (Wong and Ngai, 2022). Service innovation can be perceived as "a new service" (Witell *et al.*, 2016). Firms have different views on what is perceived as novel because a firm's perception of what is novel could vary from a customer's perspective (Snyder *et al.*, 2016). This implies that originality is less important than alignment with current market sectors and that service advances are often gradual rather than abrupt. Service innovation refers to the process of developing a good or service. It is challenging to distinguish between the invention and these justifications. These explanations bring about a challenge in differentiating between the process and innovation,

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leading to the interchangeability of words like service innovation and service design (Biemans *et al*., 2016). To ensure competitiveness, service innovation should be influenced by supply market intelligence (SMI). SMI is part of market intelligence (MI), which involves gathering and analysing data about customers, competitors and the markets to facilitate better decisions (Hargraves, 2008). The capacity to gain useful knowledge about the supply market is known as supply market intelligence (SMI), and it is a key component of efficient purchasing and supply management (PSM) (Handfield, 2006; Lorentz *et al*., 2020). With the right SMI and SI, supply chain performance can easily be achieved in both services and production enterprises. Supply chain performance refers to a situation where there is a collaboration between businesses and suppliers to ensure cohesive procedures where supplies in a raw form, natural resources, are processed into final products and then delivered to the intended clients (Autry *et al*., 2010; Rehman *et al*., 2018). The number of available technologies and the issue of information asymmetry, according to Qrunfleh and Tarafdar (2014), are the main reasons supply chain performance is often obtained or enhanced with increasing complexity. Supply chain performance depends on innovation and how it is applied to support performance. Without management and personnel capabilities, innovation, the primary driver in dealing with today's extreme levels of competition, cannot occur (Wamba *et al*., 2017).

Given the vast research interest in SCP and innovation in the empirical literature, proof pointing to how significant SMI is to SCP and SI is missing, especially in the health sector in developing countries. The achievement of positive health statistics has grown to be a key priority on a national and international scale. The Sustainable Development Goals (SDGs) focus on health is seen in goal 3, which seeks to "guarantee healthy lifestyles and promote well-being for all at all ages" (WHO, 2016).

Vision 2020 and SDGs define developmental goals that are laced with health goals (Ampaw *et al*., 2020). For instance, SDG 3, which is core on health among the other SDGs, has its targets 3.1, 3.2 and 3.3 quite clear on reducing global maternal mortality, decreasing infant mortality and ending the plague of tuberculosis, malaria, AIDS and forsaken tropical diseases as well as fighting hepatitis, waterborne illness and other contagious illnesses, respectively (WHO, 2016). Effective healthcare services remain a crucial factor in determining economic development and progress. A healthier population has higher productivity, partly because of increased work savings and hours (Bloom *et al*., 2004). The health-led growth theory also explains the causal link between health expenditure and economic growth, which contends that productivity increases when investments are made in improving health. The desire to learn new skills and information is always present in a healthy workforce, and the opposite is equally true (World Bank, 2007). Many in need of healthcare still cannot access important medical ministrations. Even now, 50% of people worldwide are unable to get basic healthcare (Wagstaff *et al*., 2018). Many African countries are still faced with the challenges of poor service innovations, out-of-date technology and ineffective supply chains in their health industries, limiting patients from accessing quality healthcare (Ikwu *et al*., 2021). The South African NDoH has been very hard-working in ensuring quality healthcare at all levels (Meyer *et al*., 2017). The healthcare ecosystem comprises the institutions, groups and resources that work together to achieve specific health outcomes through healthy behaviours.

Ghana's central government, through the Ghana Health Services (GHS) and Ministry of Health (MoH), primarily provides healthcare services. In addition to governmental services, there is a private medical care service system (Ampaw *et al*., 2020). Ghana has a government with four tiers, including sub-district levels, district, regional and national. Along these administrative systems, healthcare is also decentralised and the entry point for the primary healthcare system is noted to be at the community level. The health system in Ghana is doing better than that of the majority of other African nations when compared to WHO health metrics. For instance, the profile of WHO stated that 2016 would see a 63-year-old average life expectancy in Ghana, which would be higher than the continent's average life expectancy. The healthcare (HC) sector greatly benefits from the essential role of the healthcare supply chain (HCSC). HC is a hybrid sector that offers both goods and services, including medications,

medical supplies, equipment, waste management, IT, catering, fleet management and laundry services (Hossain and Thakur, 2021).

Service innovation and market intelligence research have largely been carried out in different sectors. For instance, the work of Jermsittiparsert *et al*. (2019) was on the impact of market intelligence and service innovation on the efficiency of the Indonesian fishing industry's supply chain. There is a lack of empirical works that have assessed the role supply market intelligence plays in service innovation and the performance of the supply chain in the health sector. A literature review demonstrates a few studies have investigated the role of the Internet of Things in health services in rural communities (Boakye and Olumide, 2021) and the relationship between service innovation and customer satisfaction: the importance of customer value creation (Mahmoud *et al*., 2018). These studies are not health-focused. With the constant upspring of pandemics, which usually leaves the African health systems devastated (Ikwu *et al*., 2021), it becomes imperative to investigate the impact supply market intelligence has on service innovation and supply chain performance in the healthcare systems to discover ways by which it can be resilient toward pandemics.

Furthermore, research on market intelligence and service innovation has largely concentrated on the developed country context, which possesses a resilient healthcare industry as compared to developing countries, but even so, without consideration of their effect on supply chain performance (Hossain and Thakur, 2021; Maghrabi *et al*., 2011). As a result, this study's findings may not be applicable in the context of developing countries. Hence, it is necessary for research to be conducted in the underdeveloped world in the future to bridge the gap between the majority of studies conducted in the developed world and the few studies carried out in the developing world.

Notwithstanding, the Ghana Health Service is still challenged by the provision of high-quality medical care in the absence of supply market intelligence, service innovation and improved supply chain performance, making this study relevant. This study, therefore, seeks to answer these questions as follows:

RQ1. What are the effects of supply market intelligence on service innovation?

RQ2. What are the effects of supply market intelligence on health supply chain performance?

RQ3. What is the mediating role of service innovation on the effects of supply market intelligence and health supply chain performance?

2. Theory and hypothesis development

2.1 Resource dependence theory (RDT)

The resource dependence theory examines how external resources have an impact on an organisation's behaviour. Organisations could not be completely self-sufficient in terms of all the resources needed for efficient operation (Reid *et al*., 2001). As a result, a firm's ability to obtain essential resources from the outside world is a requirement for organisational sustainability. However, doing so tends to add uncertainty to the firm's decision-making processes. Organisations typically aim to restructure their dependencies using several strategies to eliminate uncertainty over the flow of necessary resources. The most well-known of such strategies is "constraint absorption" (Casciaro and Piskorski, 2005), one method through which businesses, might to a limited extent, engage restraints in official, lengthy contracts like IOS (Pfeffer and Salancik, 1978). The reciprocal advantages of IOS allow SC members to progress in the direction of extra-cooperative extended business partnerships (Klein and Rai, 2009). Any firm that outsources a portion of component production needs to pay close attention to its SC relationships. For example, in the automotive industry, a variety of sophisticated production tasks are delegated to smaller companies for the manufacture of parts

(Kim *et al*., 2014). Manufacturers of automotive components work with their suppliers to apply IOS to reduce uncertainty over the continued acquisition of necessary parts. The environmental concerns encountered by participants of the SC (Wang *et al*., 2006), the reliance of organisations on associates (Kumar *et al*., 1995), and the shared governance framework among partners are antecedents for successful inter-organisational relationships identified in existing RDT-based studies.

2.2 Supply market intelligence and service innovation

Literature suggests that access to timely and accurate information about the supply market enables organisations to identify emerging trends, customer needs and technological advancements. This understanding facilitates the development of innovative services that are responsive to market demands (Lezoche *et al*., 2020). For instance, studies by Hmoud *et al*. (2023) and Sjödin *et al*. (2021) have shown that organisations with effective supply market intelligence systems are more likely to introduce novel services that meet or exceed customer expectations. Therefore, based on this literature, we hypothesise that:

H1. Supply market intelligence is positively associated with service innovation

2.3 Supply market intelligence and health supply chain performance

Supply chain management research emphasises the critical role of information in enhancing supply chain performance. Specifically in the healthcare sector, where the demand for efficiency and quality is high, access to accurate and timely information about suppliers, market trends and regulatory changes can significantly impact supply chain performance. Studies by Lorentz *et al*. (2020), Handfield *et al*. (2022) and Ivanov (2023) have highlighted the importance of supply market intelligence in improving supply chain responsiveness, reducing cost and mitigating risks. Hence, based on the literature, we hypothesise that:

H2. Supply market intelligence is positively associated with health supply chain performance

2.4 Service innovation and supply chain performance

Organisations that invest in developing and offering innovative services gain competitive advantages, including improved operational efficiency and customer satisfaction. In the healthcare sector, service innovation can lead to better patient outcomes, streamlining processes and enhanced resource utilisation. The positive impact of service innovation on organisational performance and customer experience in various industries is evident in the research findings of Mihardjo *et al*. (2019) and Ibrahim and Yusheng (2020). Following this background, the research hypothesises that:

H3. Service innovation is positively associated with health supply chain performance.

2.5 The mediating role of service innovation on the effects of supply market intelligence on health supply chain performance

Building on the previous hypotheses, we propose that service innovation mediates the relationship between supply market intelligence and health supply chain performance. This proposition is supported by literature on mediating effects, which suggests that intermediate variables such as service innovation can explain the underlying mechanisms through which certain factors influence outcomes. Specifically, Eidizadeh *et al*. (2017), Prange and Pinho (2017) and Yu *et al*. (2017) have demonstrated the mediating role of innovation in the relationship between external factors (such as market intelligence) and organisational performance. Therefore, based on this literature, we hypothesise that service:

H4. There is a positive influence of the mediating role of service innovation on the effects of supply market intelligence on health supply chain performance (see Figure 1).

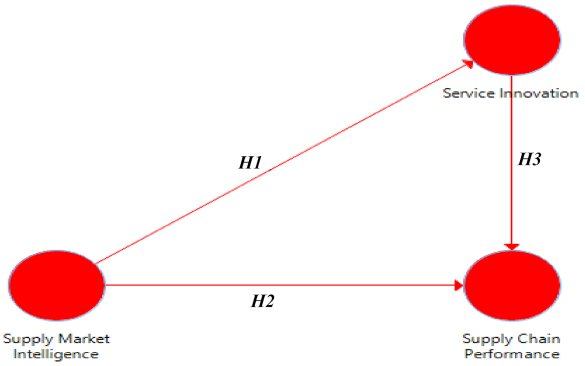

Figure 1. Research model

3. Research methodology

To study the links between SMI, SI and SCP, we adopted items empirically proven in earlier work. Items measuring constructs such as SMI were adapted from Lorentz *et al*. (2020). The SI construct was adapted from Witell *et al*. (2016) and SCP from Rehman *et al*. (2018). The questionnaire used for data collection was divided into two parts: Part A focused on demographics, and Part B focused on knowledge of each construct in our model using a five-point Likert scale ranging from 1 (strongly disagree) to 5 (strongly agree).

Data were collected using a convenience sampling technique. The choice of the sampling technique allows the assessment of elements in a population through a point of contact practically and expediently (Senyo and Osabutey, 2020).

Survey data was from supply officers of teaching and regional hospitals in Ghana. Survey data was collected using Google Forms. The questionnaire was shared on social media with participants. To fulfil the sample size requirement, we followed Hair *et al.*'s (2011) "10 times rule", which posits that the minimum sample size requirement should be ten times the highest number of structural paths directed at a specific construct in the structural model. Based on this, the construct with the highest number of items in our model is SMI and SI with five items each. Therefore, a minimum sample of 50 was required (i.e. 10*5) to undertake the study. However, data were collected from 52 respondents, which was sufficient for the study.

We piloted the initial questionnaire to determine the reliability and validity of the survey instrument. Data were initially collected from ten respondents to check the appropriateness of the survey instrument. Based on the outcomes of the pilot test, we modified questions on the relationship between SMI, SI and SCP. After this, data collection began. Initially, data were gathered from 79 respondents. However, 52 were deemed suitable for use in our study. Given that the minimum sample required to undertake this study was 52, we deemed the number of responses sufficient for this study.

4. Analysis of the findings

The four steps in the data analysis procedure were evaluations of the structural model, the measurement model and the descriptive analysis. The measurements and structural model evaluations were done following PLS-SEM, using the SmartPLS programme. PLS-SEM was chosen for the inquiry because, when compared to other techniques, it can handle complex interactions, has a small sample size and has a sample distribution in a skewed form (Hair *et al*., 2019) (see Figure 2).

5. Assessment of the measurement model

Indicator reliability, internal consistency reliability, convergent validity and discriminant validity were all examined as part of the measurement model's analysis (Hair *et al*., 2019).

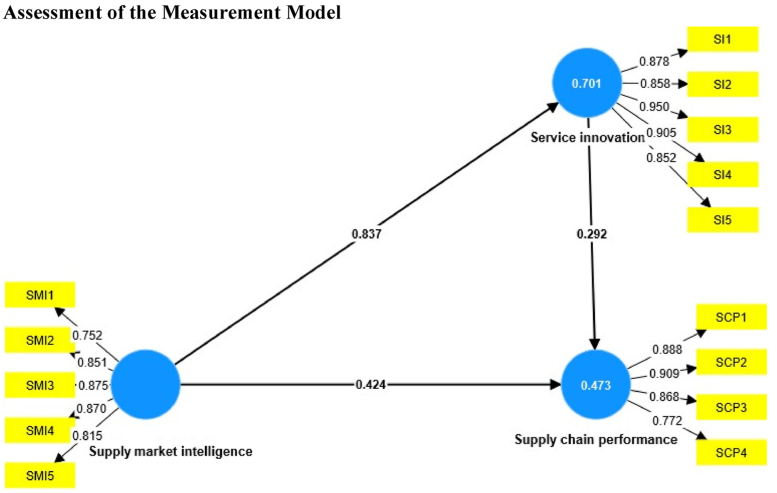

Figure 2. PLS-SEM result

Reflective loadings were used to test the indicator reliability. For acceptable indicator reliability, reflective loadings of at least 0.708 are advised. According to Figure 2, all indicators scored at least 0.708, indicating good indicator dependability. Internal consistency reliability was evaluated using Cronbach's alpha and composite reliability (CR) values (Fornell and Larcker, 1981). Ideal values for the CR and Cronbach's alpha to indicate adequate internal consistency are 0.70 and higher. Cronbach's alpha and CR values are shown in Table 1 below. Table 2 shows that the results of the Fornell and Larcker (1981) criterion test for discriminant validity were satisfactory (see Tables 2 and Table 3).

6. Assessment of structural model

By assessing the variance inflation factors (VIFs), which were below the necessary level of 5, as shown in Table 4 below, we first evaluated the structural model for collinearity issues.

Table 1. Construct reliability and validity

	Cronbach's alpha	Composite reliability (rho_a)	Composite reliability (rho_c)	Average variance extracted (AVE)
Service innovation	0.934	0.938	0.950	0.791
Supply chain performance	0.883	0.899	0.919	0.741
Supply market intelligence	0.890	0.895	0.919	0.695

Table 2. Discriminant validity; Fornell–Lacker criterion

	Service innovation	Supply chain performance	Supply market intelligence
Service innovation	0.889		
Supply chain performance	0.647	0.861	
Supply market intelligence	0.837	0.669	0.834

Table 3. Cross loadings

	Service innovation	Supply chain performance	Supply market intelligence
SCP1	0.585	0.888	0.574
SCP2	0.636	0.909	0.651
SCP3	0.523	0.868	0.622
SCP4	0.466	0.772	0.425
SI1	0.878	0.562	0.733
SI2	0.858	0.513	0.714
SI3	0.950	0.591	0.784
SI4	0.905	0.694	0.776
SI5	0.852	0.498	0.711
SMI1	0.605	0.516	0.752
SMI2	0.642	0.597	0.851
SMI3	0.752	0.639	0.875
SMI4	0.639	0.514	0.870
SMI5	0.822	0.511	0.815

Table 4. Inner VIF values

	Service innovation	Supply chain performance	Supply market intelligence
Service innovation		3.340	
Supply chain performance			
Supply market intelligence	1.000	3.340	

According to Table 4, VIF values range from 1.000 to 3.340, suggesting a lack of collinearity. We then looked at the coefficient of determination (R^2) values of the model's dependent constructs in Table 7. The independent construct (supply market intelligence) contributes 70.1% to the variations in service innovation and 47.3% to explaining supply chain performance, respectively.

The structural model's links and their importance are detailed in Table 5 below. We used bootstrapping with 5,000 subsamples, a 95% confidence interval and a 10% two-tailed distribution. The findings show that supply market intelligence has the greatest influence on service innovation ($t = 15.534$), then supply market intelligence has the greatest influence on supply chain performance ($t = 2.487$), and finally service innovation also has a significant influence on supply chain performance ($t = 1.553$) (see Table 6).

Table 5. Bootstrap results for direct effects

	Path coefficient	*t*-statistics (|O/STDEV|)	*p*-values	Decision
Service innovation → Supply chain performance	0.292	1.553	0.121	Not Supported
Supply market intelligence → Service innovation	0.837	15.534	0.000	Supported
Supply market intelligence → Supply chain performance	0.424	2.487	0.013	Supported

Table 6. Bootstrap results in indirect effects

	Original sample (O)	Sample mean (M)	Standard deviation (Stdev)	*t*-statistics (|O/STDEV|)	*p*-values	5.0%	95.0%	Decision
Supply market intelligence → Supply chain performance	0.244	0.241	0.162	1.503	0.133	−0.016	0.515	Not Supported

In addition to examining the model's effect magnitude, collinearity was looked for (see Table 7). This demonstrates the contribution of an exogenous latent variable to the R^2 value of an endogenous latent variable. According to the general rule, an effect is modest if $0.15<f^2<0.35$; very weak if $0.02<f^2<0.15$ and strong if $f^2>0.35$. The f square is shown in Table 8.

Table 7. *R* square

	R-square	*R*-square adjusted
Service innovation	0.701	0.695
Supply chain performance	0.473	0.451

Table 8. F square

	Service innovation	Supply chain performance	Supply market intelligence
Service innovation		0.049	
Supply chain performance			
Supply market intelligence	2.340	0.102	

7. Discussion

Several conclusions were drawn when the results were analysed. In the model shown in Figure 1, two of the three hypotheses were found to be valid. The hypothesis that service innovation positively influences supply chain performance was rejected. Despite service innovation often being regarded as a critical driver of organisational success, its impact on supply chain performance can be nuanced and contingent on various factors. Analysis drawn upon existing literature and empirical evidence does not support the assertion and provides insights into the composite dynamics between supply chain performance and service innovation. For instance, studies by Feng *et al*. (2021) and Kaczmarska-Krawczak (2019) examined the implementation of service innovation in the context of the healthcare sector and found that although service innovation improved patient care, it negatively impacted supply chain performance by increasing complexity and costs. Similarly, a study by Lii and Kuo (2016) analysed the relationship between service innovation and supply chain performance in the manufacturing industry. The results revealed that service innovation had a mixed effect on supply chain performance, with positive effects on customer satisfaction but negative effects on supply chain efficiency and responsiveness.

Hypothesis 1, which states that supply market intelligence (SMI) is positively associated with service innovation, is supported by the results of this study. The statistical results, $t = 15.534$ and $p = 0.000$, indicate a strong positive association between SMI and service innovation.

The t-value of 15.534 suggests that the relationship between SMI and service innovation is highly relevant. The *p*-value of 0.000 indicates that the relationship is significant at least at a 1% level. Therefore, it may be inferred that there is a strong correlation between SMI and service innovation. This is evident from literature, as the work of Yang (2021) discovered a direct correlation between the market share and popularity of intelligent e-commerce platforms and their capacity for service innovation. Similarly, this hypothesis is supported by Sharafuddin *et al*. (2022), who posit that adopting innovation completely leads to sustainable supply chain management practices and ultimately firm performance (Demir and Sezen, 2017). Research investigation shows there are significant connections between open innovation, co-creation and supply chain success.

The hypothesis that supply market intelligence is positively associated with health supply chain performance was supported (H2), indicating that healthcare organisations can make better decisions when they obtain data on the supply market, such as trends, costs and product availability. They can more effectively manage their inventories, make better demand predictions and pick the best suppliers. Better decisions are made as a result, and their supply chains operate better as a whole. Having market knowledge also enables healthcare organisations to be ready for upcoming threats and difficulties. They can spot any market disruptions or adjustments that can have an impact on their supply chain. They can take proactive steps to lessen their effects and guarantee a consistent supply of important healthcare supplies by being aware of these hazards in advance. This is supported by several studies, such as Jermsittiparsert *et al*. (2019), Lorentz *et al*. (2020) and Pool *et al*. (2018).

8. Conclusion, implications and future research

The objective of this study was to examine the nexus between supply market intelligence (SMI), service innovation (SI) and supply chain performance in the healthcare industry (see Figure 1 above). based on the resource dependence theory (RDT), which was validated using survey data from 52 supply officers in health facilities in Ghana and PLS-SEM. Results from the PLS-SEM analysis show that supply market intelligence significantly influences service innovation and supply chain performance. Furthermore, service innovation was found to have a negative influence on supply chain performance.

Results from the study provide key contributions to research, practice and policy. First, this research synthesises current literature to build and use a research model for identifying the antecedents of supply chain performance in Ghana's health sector. Antecedents identified were supply market intelligence and service innovation and their effect on supply chain performance. Supply market intelligence was significantly found to influence both service innovation and supply chain performance. Second, this study uniquely shows the empirical interaction between supply market intelligence, service innovation and supply chain performance using the RDT theory. Furthermore, given the scarcity of studies conducted in the area of supply chain performance in developing countries' health sectors, findings from this study make key additions to the literature in this area.

Results from this study provide key contributions to theory, practice and policy. Theoretically, this study is one of the first, to the best of the researchers' knowledge, to use resource dependence theory to examine the role of supply market intelligence on service innovation and supply chain performance: evidence from the health services industry in Ghana is utilised to provide valuable insights into how the provision of quality healthcare services could be made easy with the adoption of service innovation, supply market intelligence and improved supply chains in the healthcare systems. Also, with the concentration of prior literature on developed countries whose healthcare systems are already resilient. This study contributes to the very few ones conducted in the developing country context, especially in Africa. For practice and policy, findings from this study are intended to communicate the need for proper education on adopting service innovation in the delivery of healthcare service and its associated benefits to quality healthcare delivery. Supply market intelligence and its

consequent positive influence on supply chain performance in the healthcare industry have also been revealed by the study. Furthermore, results from this research will enable health service providers to integrate the concepts of supply market intelligence, service innovation and supply chain performance to ensure the delivery of quality health services. Similarly, practitioners and policymakers will be able to develop interventions that will make health service providers more supportive of providing quality health services in order to give patients the expected satisfaction they require.

One limitation of our study pertains to the focus on health facilities in Ghana; as such, generalising findings to other countries may not be appropriate. However, given that in recent years health facilities in Ghana are beginning to appreciate the need to apply supply market intelligence and service innovation to improve their supply chains, conducting a study in the region is necessary. We recommend future studies consider expanding our study to other countries by way of undertaking comparative studies or relying on archival data to provide robust insights into the linkages between supply market intelligence, service innovation and supply chain performance. Furthermore, although our use of 52 supply officers in health facilities in Ghana was suitable and met the minimum sample size requirement for conducting PLS-SEM analysis, future studies may consider using a larger sample size to ensure more comprehensive coverage.

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