International Journal of Engineering, Science and Information Technology
Volume 5, No. 4 (2025) pp. 360-365
eISSN: 2775-2674
Website: http://ijesty.org/index.php/ijesty
DOI: https://doi.org/10.52088/ijesty.v5i4.1483
Research Paper, Short Communication, Review, Technical Paper

Building Collaborative Advantage in Hospital Systems: The Role of Supply Chain Collaboration, Innovation, and Digital Transformation in Class C Hospitals in Java Island

Syahdani Uli*, Rina Anindita, Aprilita Rina Yanti Eff, Tantri Yanuar Rahmat Syah

Department of Doctoral Program in Management, Universitas Esa Unggul, Indonesia

**Corresponding author Email: syahdani_uli@student.esaunggul.ac.id*

The manuscript was received on 22 February 2025, revised on 15 May 2025, and accepted on 24 September 2025, date of publication 13 November 2025

Abstract

This study aims to analyze the influence of transformational leadership, digital transformation, supply chain collaboration, and innovation on collaborative advantage and the performance of type C hospitals in Java, with government subsidies as a moderating variable. Using a quantitative approach and PLS-SEM analysis on 50 hospitals, the results show that most direct relationships between variables are insignificant, except for the influence of innovation on collaborative advantage and the influence of collaborative advantage on hospital performance, which are proven to be significant. In addition, government subsidies only play a significant role in strengthening the relationship between supply chain collaboration and collaborative advantage. These results confirm that collaborative advantage is a key factor in improving hospital performance, with innovation as its main driver. Meanwhile, transformational leadership and digital transformation have not shown a strong direct influence due to bureaucratic limitations and implementation readiness. These findings also indicate that government subsidies are more effective in the early stages of establishing collaborations, rather than directly improving performance. This study highlights the importance of external collaboration strategies and innovation in improving the competitiveness of public hospitals, as well as the importance of adapting global theories to the local context in developing health policies in Indonesia.

Keywords: *Collaborative Advantage, Hospital Performance, Government Subsidies, Digital Transformation, PLS-SEM.*

1. Introduction

The quality of hospital services in Indonesia still faces significant disparities between private and public hospitals. Data from the Indonesian Ministry of Health (2023) shows that 62% of hospitals with the highest satisfaction rates are from the private sector, even though public hospitals receive higher subsidies. This phenomenon demonstrates collaborative advantage, namely the ability to create value through partnerships across healthcare actors [1, 2]. Private hospitals such as Hermina and Mitra Keluarga excel because they are able to strategically integrate logistics, information technology, and clinical services. This performance difference requires an analysis of the strategic factors that underpin such collaboration as a basis for developing health policy in Indonesia. Several studies confirm that supply chain collaboration, digital transformation, and transformational leadership play a crucial role in building collaborative advantage [3]. An organization's ability to sense and seize opportunities through innovation and technology directly impacts service quality [4]. However, government hospitals are often hampered by bureaucracy and dependence on subsidies [5]. Therefore, transformative leadership is needed to drive organizational culture change and strengthen cross-functional collaboration [6]. Therefore, this study examines the influence of leadership, digitalization, and innovation on collaborative advantage and their impact on hospital performance, with government subsidies as a moderating variable.

Hospital excellence depends not only on physical facilities but also on the ability to build external collaborations. Supply chain collaboration has been shown to improve operational efficiency, innovative capabilities, and patient experience [7, 8, 9]. Private hospitals are more adaptable to collaborative strategies due to institutional flexibility and managerial incentives, while government hospitals are often constrained by budget constraints. Meanwhile, the government is striving to strengthen public services by allocating IDR 186.4 trillion (5.6% of the state budget) in the 2024 State Budget for the health sector. However, this budget is still relatively small compared to the education and infrastructure sectors. This situation emphasizes the need for more strategic use of health subsidies to strengthen the

competitiveness of public hospitals. In addition to financial challenges, hospitals also face regulatory changes, one of which is the implementation of the Standard Inpatient Class, mandated by Law No. 40 of 2004. This regulation requires hospitals to meet a certain standard occupancy rate: 60% for public hospitals and 40% for private hospitals. This policy aims to ensure quality, sustainable, and equitable services. Its implementation requires cross-stakeholder collaboration, adjustments to capitation rates and National Health Insurance (JKN) contributions, and integration with other health regulations (Ministry of Health, 2012; Ministerial Regulation 14/2021; Ministerial Regulation 24/2016). This implementation emphasizes the urgency of synergy between regulation, collaboration, and strengthened innovation.

In terms of innovation, private hospitals are more aggressively adopting new technologies, such as telemedicine and AI systems for logistics management and diagnosis [10]. This improves service quality and patient satisfaction. In contrast, government hospitals often struggle to implement innovative transformations due to bureaucracy and poorly targeted subsidy schemes. However, through the dynamic capability framework [11, 12], government subsidies can be directed toward strengthening network collaboration and technology-based services. Ironically, a 2023 report from the Ministry of Health shows that only 53% of subsidies are spent on innovative capital expenditures, with the remainder spent on routine expenditures. This confirms that subsidies without leadership and adaptive managerial strategies do not automatically improve hospital performance. Transformative leadership has been shown to be a key differentiator between private and public hospitals. Studies by Bosak et al. and Daud et al. show that this leadership style increases staff satisfaction and productivity, and encourages value-based innovation [13, 14]. Private hospitals generally provide leaders with the flexibility to make strategic decisions, while government hospitals have limited room for maneuver due to rigid hierarchical structures. This reinforces the view that leadership style is crucial for the success of healthcare transformation. Digital transformation also plays a significant role in improving hospital performance. A study by Alabdaly et al. shows that hospitals with digital leadership are able to effectively integrate ERP, e-logistics, and AI diagnostics, thereby improving service quality while reducing operational costs [15]. Private hospitals can achieve this through strategic partnerships with the technology sector, while government hospitals are still constrained by bureaucracy and inflexible subsidy systems. A comparison of the implementation of collaborative advantage and supply chain collaboration reveals striking differences: private hospitals excel in process efficiency, business synergy, resource access, innovation, and patient satisfaction [16, 17].

Cross-industry phenomena further highlight the challenges facing hospitals. The convergence of the healthcare, technology, and logistics sectors is creating new competition. The entry of global companies like Amazon Health and Microsoft Cloud for Healthcare, as well as collaborations between private hospitals and local startups like Halodoc and Alodokter, demonstrate that the healthcare ecosystem now demands digital strategies and cross-sector collaboration [18, 19]. Government hospitals, despite being supported by subsidies, still operate within bureaucratic silos, making it difficult to adapt. This situation underscores the need for an integration of strategic variables leadership, innovation, digitalization, supply chain collaboration, and government subsidies to strengthen hospital performance in an increasingly competitive healthcare ecosystem.

2. Methods

The research paradigm follows a sequence of steps, from background and problem formulation, hypothesis formulation, data collection and evaluation, to deduction and conclusion testing [20, 21]. This research positions itself within the realm of strategic management by reviewing previous literature, including typologies of competitive thinking, changes in competitive models, and their relationship to management strategy [22]. The research unit of analysis is a type C hospital in Java, focusing on institutional performance, while the observational units include directors, managers, and key staff. The research design is quantitative, explanatory, with the aim of examining the influence of transformational leadership, digital transformation, supply chain collaboration, and innovation on collaborative advantage and hospital performance, moderated by government subsidies. The research instrument was developed by operationalizing variables drawn from relevant literature. The transformational leadership variable was adapted from Bass & Avolio [23], digital transformation from Vial [24], and Alabdaly et al. [25], innovation from Chesbrough [26], supply chain collaboration from Cao & Zhang [27], collaborative advantage from Dyer & Singh [28], and hospital performance using the Balanced Scorecard framework [29]. The instrument was developed as a questionnaire with a 5-point Likert scale. Validity and reliability tests were conducted using Exploratory Factor Analysis, Cronbach's Alpha, and Composite Reliability, resulting in 54 valid questions out of a total of 66. Several items were eliminated because they did not meet the minimum MSA value of 0.5, for example, in the variables hospital performance, digital transformation, transformational leadership, supply chain collaboration, and collaborative advantage. This ensured the instrument was of high quality and appropriate. The data collection process was carried out by distributing questionnaires to relevant respondents, namely hospital leaders and managers. To avoid bias, a Common Method Bias (CMB) test was conducted using the Full Collinearity VIF as recommended by Kock & Lynn [30]. The results show that all constructs are below the critical threshold of 3.3, thus free from common method distortion. Data were analyzed using the PLS-SEM approach, which is considered appropriate for complex models with mediating and moderating variables and limited sample sizes. Furthermore, this study combines two-way ANOVA to compare differences between hospital groups (public vs. private, and based on location) while simultaneously testing causal relationships between latent constructs. Thus, Chapter IV confirms that this study not only offers a new theoretical framework but also a rarely used methodological approach in hospital management studies, thus contributing to the development of both the literature and managerial practice.

3. Result and Discussion

From the 50 hospitals selected, 60% were government-owned and 40% were private. Locations were fairly evenly distributed across six provinces on Java Island, with the largest proportion in Jakarta (24%). This ensured diverse representation in terms of both ownership and geographic location, allowing the research results to reflect the varying conditions of hospitals across regions. This proportion also strengthens the validity of comparisons between government and private hospitals in terms of performance and implementation of managerial strategies. Validity and reliability testing of the research instrument showed that most questionnaire items met strong statistical criteria. Of the 66 questions, 54 were declared valid and reliable, while 12 items were eliminated because their Measure of

Sampling Adequacy (MSA) values did not meet standards. The research instrument demonstrated high reliability, with Cronbach's Alpha and Composite Reliability values above 0.90. This ensures that constructs such as transformational leadership, digital transformation, innovation, supply chain collaboration, collaborative advantage, and hospital performance can be measured consistently and accurately.

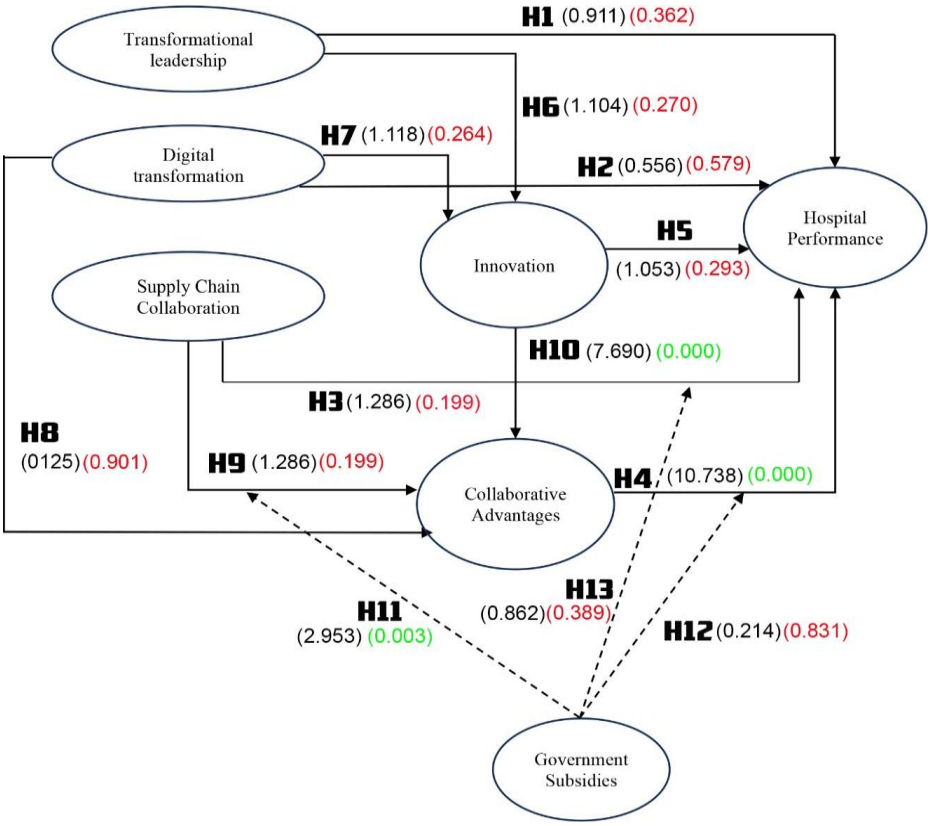

Fig 1. Hypothesis Testing

Structural model analysis using PLS-SEM showed that not all proposed hypotheses were accepted. Several direct relationships, such as the effect of transformational leadership on hospital performance and the effect of digital transformation on collaborative advantage, were rejected due to insignificant p-values. Conversely, the relationship between innovation and collaborative advantage ($p < 0.05$) proved significant, indicating that innovation is an important variable in building collaborative advantage in hospitals. Furthermore, the relationship between collaborative advantage and hospital performance was also significant, confirming the important role of cross-functional collaboration in improving performance.

Other hypothesis testing revealed that supply chain collaboration did not directly affect hospital performance. However, with government subsidies, the relationship between supply chain collaboration and collaborative advantage became significant ($p = 0.030$). This means that fiscal support from the government can strengthen the positive impact of supply chain collaboration on collaborative advantage, which in turn affects hospital performance. This finding aligns with Liu et al. and Duan et al. emphasized that public subsidies can be a catalyst for strengthening innovation and collaboration in the healthcare sector [31, 32]. Moderation tests showed mixed results. Government subsidies were shown to significantly moderate the relationship between supply chain collaboration and collaborative advantage, but not significantly moderate the relationship between supply chain collaboration and hospital performance or collaborative advantage and hospital performance. Thus, subsidies function as an enabler that supports collaboration but does not directly alter the impact of collaboration on performance. This confirms that subsidies are more effective at the collaborative advantage formation stage than at the final stage, which is directly related to performance.

Table 1. Upsilon Mediation Statistics (V)

Variable	V
DT -> INN->HP	0.000
TL->INN->CA	0.016
TL->INN->HP	0.000
DT -> CA->HP	0.000
SC->CA->HP	0.022

Mediation path analysis (upsilon statistic) revealed that most mediation effects were in the very low to low category (Ogbeibu et al., 2020). For example, the indirect effect of digital transformation on hospital performance through innovation was very low ($V = 0.000 <$

0.01). Similarly, the effect of transformational leadership on hospital performance through innovation was also low. However, the link between supply chain collaboration and hospital performance through collaborative advantage showed a low mediation effect (V = 0.022 > 0.01), indicating the role of collaborative advantage as a bridge between supply chain collaboration and hospital performance.

This finding aligns with a study by Chandra & Kumar [33], which found that cross-organizational collaboration only has a significant impact on performance when it manifests in tangible collaborative advantages, such as efficient drug distribution, improved service quality, or reduced logistics costs. In other words, collaboration is not sufficient at the level of coordination; it must generate measurable added value for hospitals and patients. Innovation is also seen as an important mediator, although its influence is limited, as it requires the support of an adaptive organizational structure [34, 35]. Overall, the mediation results show that the role of innovation and collaborative advantage variables is not optimal in the context of hospitals on the island of Java. Limited digitalization implementation, bureaucratic rigidity, and a lack of human resource readiness are inhibiting factors. This explains why digital transformation and transformational leadership did not significantly influence hospital performance, in contrast to findings in developed countries [36, 37, 38]. Thus, this study confirms that local context significantly influences the validity of global theory. Outer model analysis indicates that the research indicators are of excellent quality. All outer loading values are above 0.70, with most exceeding 0.90. The Average Variance Extracted (AVE) value exceeds the 0.50 threshold, indicating that the indicators adequately explain the construct variance. This consistency provides a strong basis for interpreting the inner model results with a high degree of confidence. In other words, the quality of the research instrument supports the validity of the findings regarding the relationships between latent variables.

The descriptive results demonstrate a relatively balanced distribution of sample hospitals between government (60%) and private (40%). This representation is important because ownership has been shown to influence managerial flexibility, innovation adoption, and dependence on subsidies [39, 40]. The distribution of hospitals across six provinces in Java also highlights the variation in health ecosystem conditions, with Jakarta tending to be more advanced in facilities than Central Java, Yogyakarta, or East Java. This finding supports the ecosystem theory, which states that location and regional context influence the performance of healthcare organizations. The following discussion highlights hypothesis testing. The results indicate that transformational leadership does not significantly impact hospital performance. This finding contrasts with international literature [41, 42], which emphasizes the role of transformative leadership in building organizational commitment. In the context of type C hospitals in Indonesia, bureaucracy, limited autonomy, and organizational cultural resistance are obstacles that hinder leadership's ability to drive performance improvements. This underscores the importance of considering structural factors when adopting global theory. Digital transformation also has no significant impact on hospital performance. This is despite numerous studies emphasizing the crucial role of digitalization in service efficiency [43, 44]. This gap can be explained by the fact that technology adoption in Type C hospitals is still minimal, both in terms of human resources and infrastructure. Digitalization has not yet touched strategic aspects such as e-logistics or patient data integration, so its impact on performance is not yet visible. Conversely, innovation has a significant impact on collaborative advantage. This aligns with dynamic capability theory, which emphasizes the importance of sensing and seizing opportunities through innovation [45]. Hospitals capable of developing innovation, both clinical and managerial, tend to be more successful in building collaborative advantage. This finding is consistent with Hussaini et al. who stated that innovation is the key link between internal resources and the added value of external collaboration [46]. Collaborative advantage has been shown to significantly impact hospital performance. Collaboration with logistics, pharmaceutical, and technology partners can improve cost efficiency, service quality, and institutional resilience. These findings align with Chandra & Kumar who emphasized that effective collaboration only generates value if it is realized in the form of tangible operational excellence [47]. Thus, collaborative advantage acts as a key variable bridging external factors with improved hospital performance.

The results also show that supply chain collaboration is not directly significant for hospital performance. However, with government subsidies, the relationship between supply chain collaboration and collaborative advantage becomes significant. This means that public subsidies act as an enabler that strengthens supply chain collaboration, thereby creating collaborative advantage. This finding aligns with Liu et al. and Duan et al. who stated that public subsidies strengthen an organization's ability to manage strategic collaboration [48, 49]. A moderation test confirmed that government subsidies were significant only in the relationship between supply chain collaboration and collaborative advantage. However, subsidies did not moderate other relationships, such as collaborative advantage and hospital performance. This means that subsidies function more in the initial stages of collaboration formation than in the later stages related to performance outcomes. In other words, subsidies encourage collaboration, but do not directly guarantee improved performance. This suggests the need for subsidy policy design that focuses more on performance-based outcomes. Discussion of mediation effects revealed that most mediation pathways were in the low to very low range [50]. For example, the effect of digital transformation on hospital performance through innovation was almost non-existent, while supply chain collaboration on hospital performance through collaborative advantage showed a low but still significant effect. This indicates that mediation is occurring but not yet optimal, likely due to limited implementation of innovation and digitalization.

Theoretically, this study emphasizes the importance of local context in testing global theories. Transformational leadership and digital transformation have been shown to be significant in international studies, but they do not function optimally in type C hospitals in Indonesia. This can be explained by different structural, bureaucratic, and human resource readiness factors. Thus, this study enriches the global literature by demonstrating that variables considered universal are actually contextual. Practically, these findings offer implications for hospital management and policymakers. First, hospital management needs to strengthen its capacity for innovation and external collaboration, as these have been shown to significantly impact performance. Second, digitalization should be directed not only at administrative aspects but also at clinical and logistical integration for a more tangible impact. Third, public subsidies should be designed with performance-based governance in mind to not only strengthen collaboration but also contribute to improved healthcare performance.

This study also identified several research gaps. First, the theoretical gap related to transformational leadership and digital transformation was insignificant, in contrast to the global literature. Second, the moderation gap, as government subsidies are rarely studied as a moderating variable, despite this research demonstrating their significant role in the early stages of collaboration. Third, there is a methodological gap, as this study combines PLS-SEM with two-way ANOVA to evaluate both causal relationships and differences between groups. This combination of methods is relatively rare in hospital management studies and represents a novel contribution to research methodology. Furthermore, the discussion also highlights the performance differences between private and public hospitals. Private hospitals tend to outperform public hospitals in terms of hospital performance. This can be explained by organizational flexibility, market orientation, and lower dependence on subsidies. In contrast, public hospitals face bureaucratic limitations that hinder

innovation and digitalization. This difference underscores the urgency of collaborative and innovation strategies to counterbalance the structural limitations of public hospitals.

4. Conclusion

This study examines the influence of transformational leadership, digital transformation, supply chain collaboration, innovation, and collaborative excellence on the performance of type C hospitals in Java, with government subsidies as a moderating variable. The results of the PLS-SEM analysis indicate that most direct relationships are insignificant, except for the influence of collaborative excellence on hospital performance and innovation on collaborative excellence, which are proven to be significant. Furthermore, government subsidies only strengthen the relationship between supply chain collaboration and collaborative excellence. These findings confirm that collaborative excellence is a key factor in improving hospital performance, with innovation as the main driver of the formation of this excellence. On the other hand, the role of leadership, digital transformation, and supply chain collaboration have not had a significant direct impact, indicating that these internal factors have not been optimally implemented in type C hospitals. This study also highlights the importance of external factors such as government support and the ability to manage strategic partnerships in driving the performance of healthcare institutions, and reveals a gap between global theoretical findings and the reality of implementation in the local Indonesian context.

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