Journal of Nusantara Studies 2025, Vol 10(2) 634-654
Universiti Sultan Zainal Abidin
ISSN 0127-9386 (Online)
http://dx.doi.org/10.24200/jonus.vol10iss2pp634-654

ENHANCING HOSPITAL RESILIENCE: DYNAMIC CAPABILITIES IN THE DIGITAL AGE

[1,2]Zhang Tongtong, [3]Jamaliah Said, [*3]Nor Balkish Zakaria,
[3]Naila Erum & [4]Yvonne Joseph Ason

[1] Financial Department, General Hospital of Ningxia Medical University,
Yinchuan, Ningxia, 750003, China.
[2] Faculty accounting, Universiti Teknologi MARA (UiTM) Cawangan Sabah,
88997 Kota Kinabalu, Sabah, Malaysia.
[3] Accounting Research Institute, Universiti Teknologi MARA (UiTM),
40450 Shah Alam, Selangor, Malaysia.
[4] Faculty of Business Management, Universiti Teknologi MARA (UiTM) Cawangan Sabah,
88997 Kota Kinabalu, Sabah, Malaysia.
[*]Corresponding author: norbalkish @uitm.edu.my

Received: 10.01.2025 Accepted: 02.06.2025

ABSTRACT

Background and Purpose: Public healthcare is closely related to public welfare. With uncertain events becoming more frequent, public healthcare organizations' ability to survive and thrive in dynamic environments has become critical. As the pillar of the system, resilient public hospitals help maintain the sustainability of healthcare services in adverse situations. Integrating digital technologies into the system becomes imperative for resilience, especially during crises such as the COVID-19 pandemic. This study explores the effect of digital technologies' dynamic capability on enhancing resilience in public hospitals. It creates a framework combining dynamic capabilities theory with resilience, with innovative applications in healthcare in developing countries.

Methodology: This study analysed 249 validated online questionnaires from management and staff of public hospitals in China using structural equation modelling partial least squares (SEM-PLS) to identify and assess the effect of digital technologies on public hospitals' resilience.

Findings: This study finds a positive effect of the synergy and innovative capabilities of digital technologies on public hospital resilience, indicating that investing in digital healthcare applications is significant for enhancing the robustness, adaptability, and flexibility of hospital operations in turbulent and uncertain environments.

Contributions: The finding of this study is expected to improve the management practices of digital technologies in public hospitals and help cultivate robustness, adaptability, and flexibility in public hospital operations, thereby enhancing resilience in the face of unexpected and uncertain events. This study is expected to enrich the development of healthcare resilience theories and the practice of healthcare management.

Keywords: Hospital, resilience, dynamic capability theory, digital technology, SEM-PLS.

Cite as: Zhang, T., Said, J., Zakaria, N. B., Erum, N., & Ason, Y. J. (2025). Enhancing hospital resilience: Dynamic capabilities in the digital age. *Journal of Nusantara Studies, 10*(2), 634-654. http://dx.doi.org/10.24200/jonus.vol10iss2pp634-654

1.0 INTRODUCTION

Resilience is an organization's ability to resist, adapt, and recover in an emergency (Zhang et al., 2021). In the Volatility, Uncertainty, Complexity, and Ambiguity (VUCA) age, Global economic growth, changing disease patterns, and ageing populations have led to a growing demand for quality healthcare services (World Health Organisation, 2022). This is illustrated by the trend in healthcare investment in China before the COVID-19 pandemic in 2019 (Figure 1). The global spread of the COVID-19 pandemic between 2020 and 2023 triggered economic decline, budget revenue constraints and an increase in public debt, which exposed billions of people to the socio-economic consequences (Figure 2). As the pillar of national healthcare systems, public hospitals have faced challenges brought by interruptions to public healthcare services, such as shortages of medical staff, beds, and staff (Barbash & Kahn, 2021). Even after the end of the COVID-19 pandemic in 2023, the world is still facing future threats of the X-variants pandemic, which highlights the importance of investment in healthcare system resilience (World Health Organisation, 2023). Resilient organizations are considered to have robustness, adaptability, and flexibility in coping with future uncertain sudden shocks. To maintain the primary healthcare service for the public and quick recovery from the crisis, public hospitals should develop and enhance their resilience.

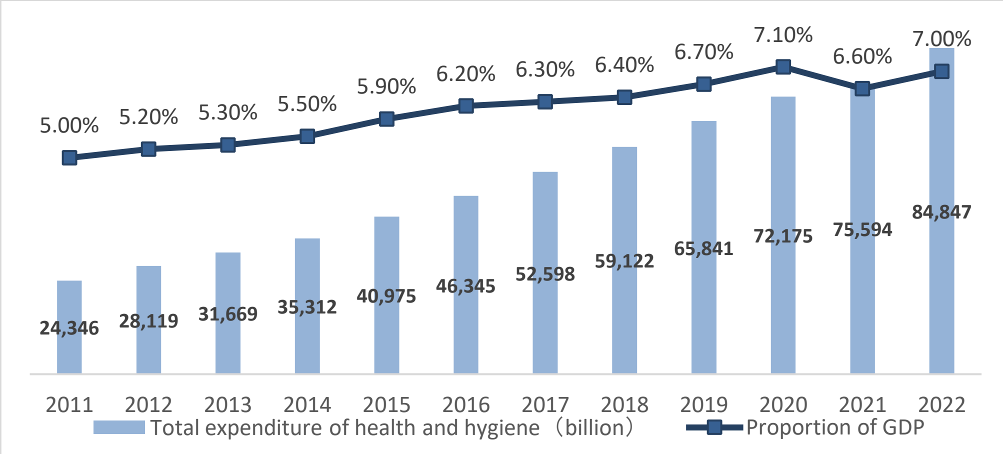

Figure 1: The total health expenditure and GDP share between 2011 and 2021 in China

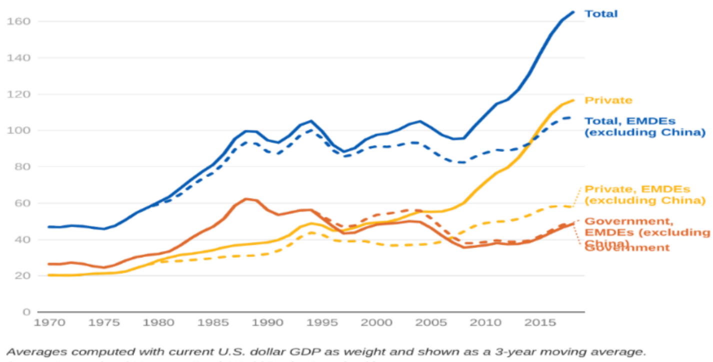

Figure 2: Debt in the world and EMDEs (Emerging markets and developing economies)

Dynamic capability is "the ability of an organization to sense, seize, and reconfigure resources and skill to address rapidly changing environments" (Teece et al., 1997). Based on the dynamic capability theory, identifying and enhancing an organization's dynamic management capability can help develop Resilience (Akpan et al., 2022). Lisdiono (2022) analyzed Indonesian state-owned enterprises (SOEs) and their subsidiaries by conducting a questionnaire survey of boards of directors and senior management to argue that digital technology capability enhances the Resilience of SOEs. A study by Chowdhury and Quaddus (2017) investigated the effect of dynamic capabilities on supply chain resilience by a mixed methods approach. Furthermore, Alvarenga et al. (2023) found that utilizing digital technology has a U-shaped effect on organizational resilience. This resilience stems from the association between digital technology use and risk identification. Sabahi and Parast (2020) and Li et al. (2023) confirmed the role of innovation capability as a dynamic capability to enhance organizational resilience. Fleisch et al. (2021), Jin et al. (2022), and Zhang et al. (2025) argued that digital security positively impacts healthcare organizations' operations. Although there have been several studies that have addressed the role of digital technology innovation, security, and other factors influencing the operation of healthcare organizations, there is still a lack of a comprehensive framework for evaluating the impact of digital compatibility, synergy, innovation, and digital security on the resilience of public hospitals under dynamic environment. Most previous studies on public hospitals have focused on static performance influencing factors, and empirical data on the mechanisms affecting the resilience of public hospitals in a dynamic environment are still limited.

Therefore, building a comprehensive framework to explore the impact of digital technological capabilities (digital compatibility, digital synergy, innovation, and security) on hospital resilience in public hospitals is necessary. Based on the above gap and the dynamic capability theory, this study adopts a Structural Equation Modelling (SEM-PLS) method to identify the critical capabilities of digital technologies' effect on the resilience of public hospitals. This topic will be discussed throughout this study.

Section 2 reviews the literature on dynamic capabilities theory and organizational resilience, and Section 3 presents the study's hypothesis and the research framework. Section 4 describes the research methodology, followed by Data Analysis in Section 5 and the findings and discussion in Section 6. Section 7 presents the conclusion of the study. Lastly, section 8.0 has managerial implications and limitations.

2.0 LITERATURE REVIEW

2.1 Dynamic Capability Theory

Teece et al. (1997) defined dynamic capabilities as the organization's capability to sense, seize, and reconfigure (internal and external) resources to address rapidly changing environments. Dynamic capability focuses on changes in the organization's external environment, which emphasizes the organization's ability to mobilize and reconfigure resources and develop dynamic management capability, which helps improve cross-sector collaboration and decision-making. Based on the dynamic capability theory, organizations cultivate management capability to sense and identify the change and risk in a dynamic external environment and take appropriate activity quickly (Sabahi & Parast, 2020; Cavusgil & Deligonul, 2025), then seizing and utilizing the resources and opportunity through improving coordination and collaboration, and reconfigure resources in response to changing circumstances to improve robustness, adaptability, and flexibility and enhance organizational response capability under normal operating conditions and emergency event break out (Hillmann & Guenther, 2021). Meanwhile, the resilience viewpoint encourages organizations to build redundant, resourceful, adaptable, and flexible management capability systems. Therefore, it aligns with the perspective of the Dynamic Capability Theory. Dynamic capabilities help to build resilience by providing the organization with the necessary capabilities in an uncertain and dynamic business environment (Ye et al., 2023).

2.2 The Resilience of Public Hospitals

Resilience refers to the capability of an organization to effectively anticipate, prepare to respond, and recover from disruptions caused by adverse events, such as uncertain natural disasters and epidemics (Kruk et al., 2015; World Health Organization, 2023). The importance of robustness, redundancy, resource availability, and speed was emphasized to measure an organization's Resilience (Wieland & Durach, 2021). Sari et al. (2024) consider hospital resilience to be the ability of a hospital to resist, absorb, and cope with a disaster while maintaining its critical functions and then recover to its original state or even adapt to a new state. Public hospitals are one of the most complex public sectors and closely related to public health benefits. Maintaining its daily operations and resilience in emergencies is critical (Aldrighetti et al., 2019).

The shortages and disruptions caused by the COVID-19 outbreak exposed insufficient resilience, especially about its address and containment of the pandemic. These aspects pose challenges to maintaining a sustainable supply of essential health services and highlight the need for resilience of public hospitals as pillars of the public healthcare system (Donelli et al., 2021). Robustness serves as the basis for organizational Resilience (Munoz et al., 2022), and the outcome of maintaining organizational viability during disruptive times can be measured by robustness (Hillmann & Guenther, 2021). The built adaptability helps to prepare for emergencies, response to disruptions, and recovery by maintaining continuity operations (Yan et al., 2023). Flexibility is the most frequently cited resilience factor (Hundal et al., 2021), which refers to the ability of an organization to efficiently redeploy or shift resources to higher-yielding activities that create and protect an organization's primary value (or capture value) (Yoshikuni et al., 2023). Therefore, in this study, robustness, adaptability, and flexibility are critical for measuring resilience in public hospitals.

2.3 Digital Capability of Public Hospitals

In the digital age, the use of digital technology in healthcare is an essential trend for the future. An organization with the latest technology is no longer a guarantee of success. What is more important is how this technology is used to help the organization reconfigure the resources and improve collaboration. From a dynamic capability perspective, digital technology capabilities build based on an organization's original resources, which can reorganize the advantageous resources to re-engineer the organization's processes and enhance the organization's ability to cope with adverse environments (Di Vaio et al., 2023; Binsar et al., 2025) In the application of digital healthcare technology, public hospitals are likely to benefit more from digital technology capacity building due to their resource advantages and regional radiation function (Ruiz-Mallorquíet al., 2021).

The application of digital technology transformed the hospital management model from a linear to a more integrated model, thereby changing the previous single, isolated digital barriers across departments and improving overall hospital management synergy (Khin & Ho, 2019). Information technology in the public sector facilitates information sharing and flow, allows real-time communication across multiple business sectors and management layers, and efficiently supports efficient and responsive business processes (Ivanov & Dolgui, 2019). Digital technologies support organizations in collecting, processing, and analyzing large amounts of data in real time, enabling managers to make informed decisions based on comprehensive information from operational and dynamic environments. Digital technology capabilities help to re-engineer business processes or collaboration and respond to external organizational changes by streamlining the processes and improving communication (Fleisch et al., 2021). Digital technology applied to hospitals can help transform data into intelligence that can be used to improve healthcare delivery and business process management to meet the surge in demand for healthcare in the face of unexpected shocks (Kitsios & Kapetaneas, 2022). Digital technology capability can help make quick decisions and better respond to operational risks associated with changes in the external environment. Moreover, applying digital healthcare technology to the hospital supply chain can ensure resource preparation and redundancy through inventory management to maintain the continuity of supplies for healthcare services (Alvarenga et al., 2023; Araujo et al., 2023). Building hospital information systems is critical to the timely and continuous delivery of resources and services to the public.

3.0 HYPOTHESES

Organizational Resilience hinges on the ability to gather and process resources effectively to navigate environmental instability (Stennett et al., 2022). Efficient utilization of information, knowledge, experiences, and other resources is essential for building enterprise resilience. Digital technology capability as a business competency helps to integrate resources and competence (Lisdiono, 2022). Healthcare organizations can benefit more from investing in cybersecurity infrastructure, fostering interoperability, and enhancing compatibility and Synergy (Paz-de-Sousa et al., 2023). This study aims to construct a dynamic capability framework to assess the critical effects of digital technology capability (digital synergy, digital compatibility, digital innovation, and digital security) on the resilience of the healthcare system. The study's hypotheses are discussed below. Digital technologies have reshaped the delivery of healthcare services. Combining management processes with digital technologies aims to improve management efficiency and departmental synergies (Di Vaio et al., 2023). In this light, the synergy between digital medical systems and medical business departments is the foundation of resilient healthcare. However, a mismatch between the application of digital systems and healthcare business activities can hinder the fulfilment of a hospital's expectations for establishing crisis response capabilities and disrupt the security and quality of health data (Binci et al., 2022). Synergizing management platforms can ensure information is shared efficiently and driven by quick decision-making and coordinated management. ICT facilitates the prompt detection of potential threats or disruptions by enabling swift response actions, mitigating the impact of disruptions, and improving Resilience (Birkie, 2016). Therefore, this study proposes the following hypothesis:

H_1: Digital medical synergy capability has a positive effect on the hospital's resilience.

With the development of digital-medical, digital application systems became complex and lacked compatibility with the hardware of digital facilities, resulting in digital barriers and response delays (Yan et al., 2020). The compatibility of digital transformation presents significant challenges for healthcare information system applications (Fleisch et al., 2021). The lack of unified planning and development separately among business departments causes a "digital island" (Andersen et al., 2019). Compatible digital technologies can mitigate the "digital island" through integration plans (Ekanayake et al., 2021). Therefore, the following hypothesis has been developed:

H_2: Digital technology Compatibility has a positive effect on hospital Resilience.

In the digital era, unpredictable environment fluctuations require organizations to improve innovation capabilities by developing their digital resources application capability (Al-Omoush et al., 2023). Digital innovation is the reinvention or creation of traditional products, services, or business processes by digital technologies (Schweitzer, 2014). After public healthcare organizations experienced the COVID-19 crisis, the healthcare sector launched a new wave of digital transformation to promote various new forms of innovation (Baudier et al., 2023). Digital technologies products in innovation, such as Big Data, the Internet of Things (IoT), and Cloud Computing, can be applied to improve collaboration and communication, data analytics, or deep learning in healthcare (Akpan et al., 2022). Meanwhile, digital innovation optimizes the management and service process, improves operation efficiency, and builds redundancy and preparation, thereby preventing disruption caused by sudden uncertain events in healthcare, which helps to enhance the hospital's flexibility and sustainability of healthcare service (Alvarenga et al., 2023). Therefore, the third hypothesis has been proposed:

H_3: Digital technology innovation has a positive effect on the resilience of public hospitals.

Security is paramount in ensuring the sustainable operation of digital technologies and the overall organization (Fleisch et al., 2021). With the development of digital technology, healthcare services rely more on digital medical equipment, which increases the risk of data leakage and abuse (Akpan et al., 2022). Security must be provided for data sharing and transfer in the medical business (Fleisch et al., 2021). Security technology applications can strengthen cybersecurity and protect patient data (Ande et al., 2020). Good data storage, backup, and recovery functions help ensure the sustainability of medical services and hospital resource supply security during emergencies and mitigate disruption impact (Fleisch et al., 2021; Zhang et al., 2021). Therefore, the following hypotheses have been proposed:

H_4: Digital technology security has a positive effect on the hospital's resilience.

The concept of healthcare resilience combines policy and practice. Management measures of digital technology should be taken to ensure the organization has a rapid recovery to a stable equilibrium as before the shock of the emergency event. The dynamic Capability Theory framework, combined with the definition of resilience, demonstrates how organizations develop and leverage dynamic capabilities to improve their response capability. Thus, this study highlights the critical role of digital technology capabilities in bolstering hospital resilience, drawing from dynamic capability theory. Based on the discussion above, the research model was constructed as shown in Figure 3.

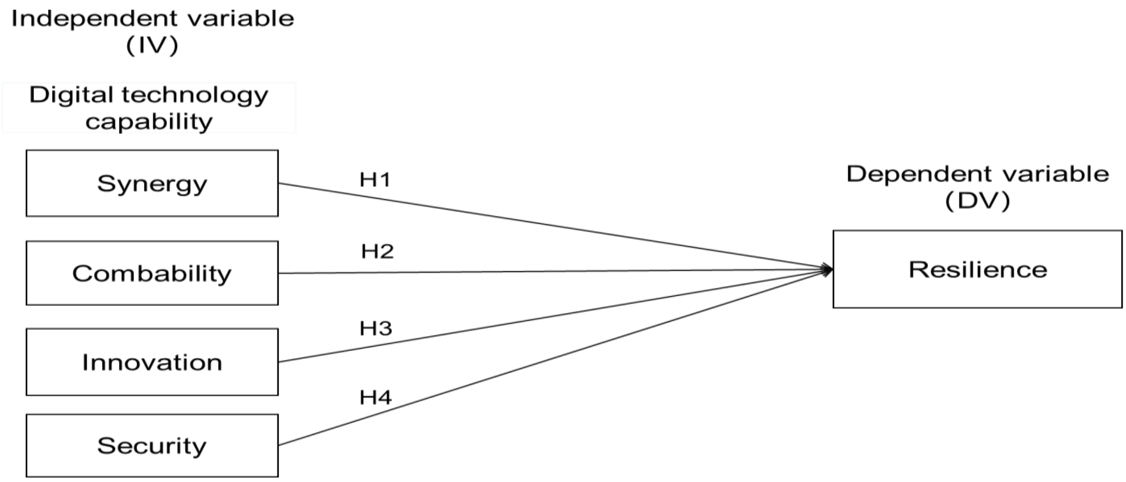

Figure 3: The digital technology capability effect on hospital resilience

4.0 METHODOLOGY

This study utilized quantitative methods and a cross-sectional design. The purposive non-probability sampling method was adopted to investigate the management and staff from tertiary, secondary, and primary public hospitals in seven provinces in eastern, western, and central China. This group was chosen as respondents as they contribute to and benefit from developing and applying digital technology capabilities and, consequently, contribute to a hospital's resilience. Then, to investigate the viewpoint of object respondents, a structural questionnaire was constructed on the WJX CN platform and distributed in the Hospital Management Conference Work Group in China between April and June 2024. A total of 350 questionnaires were distributed, and 249 were collected, resulting in a recovery rate of 71.14%. G*Power sample size calculator was used to calculate the sample size. According to the G*Power calculations outcomes, the minimum sample size for this study should be 85. At last, the respondent's sample exceeded the minimum requirement calculated by G*power, which improved the statistical power and reliability of the SEM-PLS analysis results.

The items in the questionnaire were measured using a five-point Likert scale. The questionnaire consisted of six sections. Section A is demographic information (e.g., type of hospital, position, department, years of experience, etc.). Section B of the questionnaire addressed hospitals' digital technology capabilities (Synergy, compatibility, innovation, and security). The final section contains questions on hospital resilience. These include robustness, adaptability and flexibility. The demographic data was analyzed using SPSSAU software. The data from the questionnaire were then processed using the Smart PLS 4.0 software.

5.0 DATA ANALYSIS

In this study, among the 249 study respondents (N= 249), 55.00% were male and 45.00% were female. 25.00% were aged 30 and below, 31.67% were aged between 30-40, and 43.33% were aged 40 and above. 71.67% of the respondents worked in managerial positions, 28.33% were general staff. Furthermore, 76.66% of respondents were working in public hospitals that are secondary-level and above, more than 45.00% obtained a bachelor's degree or above, and more than 70.00% had more than ten years of work experience. Therefore, the respondents of this study met the requirements in terms of work experience, educational background, and cognitive level.

Table 1: The demographic information statistic

Name	Options	Frequency	Percentage (%)	Cumulative Percentage (%)
1. Gender:	Male	137	55.00	55
	Female	112	45.00	100
2. Age	Below 30 years	62	25.00	25
	30 - 40 years	79	31.67	56.67
	41 - 50 years	95	38.33	95
	Above 50 years	12	5.00	100
3. Education:	Doctor	21	8.33	8.33
	Masters	91	36.67	45
	Bachelor or below	137	55.00	100
4. Position:	Dean	17	6.67	6.67
	Medical Director	8	3.33	10
	Procurement Director	21	8.33	18.33
	Financial Director	79	31.67	50
	Operation Director	25	10	60
	IT Director	29	11.67	71.67
	Staff	71	28.33	100
5. Years of Experience	Less than one years	25	10.00	10
	1 - 5 years	50	20.00	30
	5 - 10 years	50	20.00	50
	More than ten years	125	50.00	100
6. Level of Hospital	The tertiary hospital	95	38.33	38.33
	The second level	95	38.33	76.67
	The primary level	54	21.67	98.33
	Other	4	1.67	100
Sum		249	100	100

Based on Table 2, Cronbach's Alpha greater than 0.7 to show adequate reliability (Nunally, 1978). Moreover, the KMO value of 0.914 in Table 3 indicates that the data can be used to extract information effectively. A highly significant p-value ($p < 0.000$) suggests that the null hypothesis can be rejected, indicating a sufficient correlation between the variables. Both the KMO value and Bartlett's test of sphericity suggest that the data is suitable for factor analysis. According to the full covariance test, the results of the study's reliability and validity tests support the next step in the analysis.

Table 2: Cronbach reliability analysis

Item	**Sample**	**Cronbach α coefficient＞0.7**
26	249	0.813

Table 3: KMO and Bartlett's test

KMO-value		**0.914**
Bartlett Sphericity Test	X^2	3046.632
	df	325
	p-value	0.000

5.1 PLS Measurement Model

Table 4 shows all measurement models' reliability, convergent validity, and discriminant validity. In this study, the reliability coefficients of the models were tested using Cronbach's alpha. The results of the test showed that the reliability values of synergy, compatibility, innovativeness, security, and hospital resilience of information technology application capabilities were 0.759, 0.749, 0.805, 0.823, and 0.803, which were in the range of 0.7 to 0.9, respectively (Fornell & Bookstein, 1982; Hair et al., 2017). The composite reliability (CR) values for all model constructs were more significant than 0.70, indicating better internal consistency and reliability of the model (Fornell & Bookstein, 1982). All constructs' average variance extracted (AVE) values were more significant than 0.50, confirming more satisfactory convergent validity. The SRMR value is 0.076, less than 0.08, indicating a good fit. All VIF values are less than 3.3, which shows that the model does not have multicollinearity.

Table 4: The reliability and convergent validity of the measurement model

Construct	**Internal Consistency Reliability**		**Convergent Validity (AVE)**	**Model Fit (SRMR) < 0.08**	**Collinearity (VIF) < 3.3**
	Cronbach's Alpha (CA)	**Composite Reliability (CR)**			
Resilience	0.803	0.823	0.507	0.076	< 3.3
Synergy	0.759	0.768	0.581		2.832
Compatibility	0.749	0.754	0.571		2.322
Innovation	0.805	0.811	0.561		3.290
Security	0.823	0.836	0.533		3.000

Resource: Ornell & Larcker, 1981; Hair et al., 2017

Figure 4 shows the path model. In addition to compatibility and security, the path coefficient values for synergy and innovativeness were more significant than 0.20 (Hair et al., 2017). Security has one factor loading with a value below 0.7, and resilience has three factors loading with values below 0.70. Still, convergent validity is met as the value of AVE is above 0.5. As shown in Table 5, factor loadings and path coefficient for the research framework should be tested before hypothesis testing, and the covariance of exogenous latent variables should be tested. As shown in Table 5, each indicator loads higher on its assigned structure than any other structure, it can be inferred that the model's structures are sufficiently different from each other (Chin, 1998). According to Table 5, the cross-factor loadings in the measurement model are more significant than 0.7, and the cross-factor loadings are less than the factor loadings with a difference greater than 0.1. Thus, the measurement model has discriminant validity.

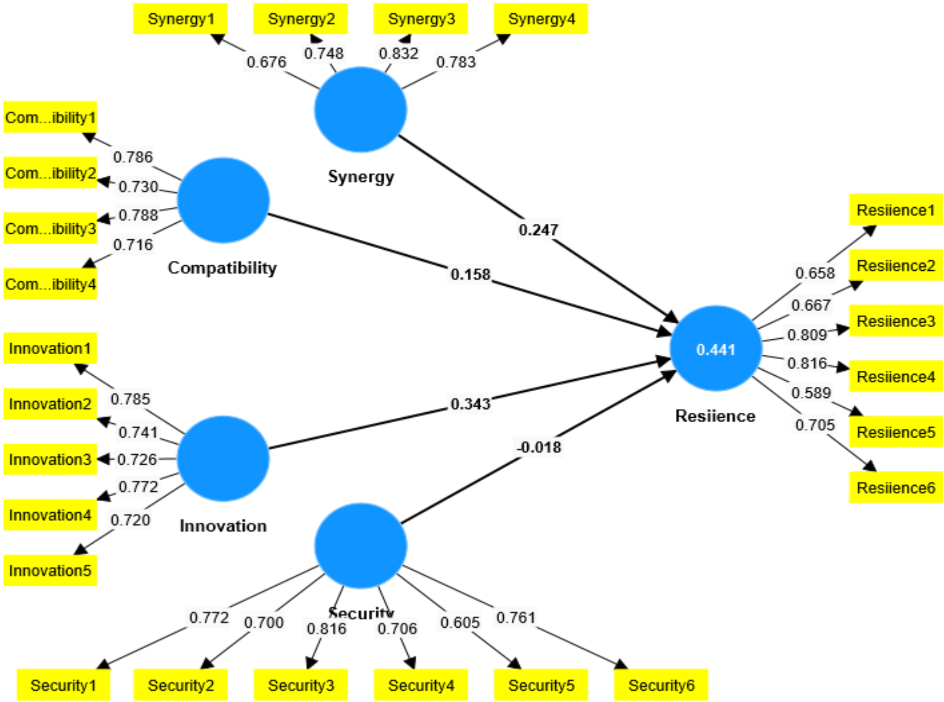

Figure 4: The path models

Table 5: The discriminable validity of the measurement model

	Resilience	Synergy	Compatibility	Innovation	Security
Resilience	0.71				
Synergy	0.45	0.76			
Compatibility	0.42	0.52	0.76		
Innovation	0.47	0.56	0.53	0.75	
Security	0.38	0.53	0.49	0.57	0.73

5.2 Structural Measurements

The results of the structural modeling are shown in Table 6. The predictive power of the model was estimated using the coefficient of determination (R^2) based on Chin (1998). The less than 0.333 and above 0.670 values can be interpreted as weakly and strongly significant, respectively. The test results in Table 6 show that the R2 value for hospital resilience is 0.441. Therefore, the model has a moderate to high predictive accuracy (Hair et al., 2017). The effect size (F^2) of the structural model relationship suggests that the Synergy innovation of information technology capabilities has a relatively strong effect on hospital resilience. In contrast, the compatibility and security of digital technology have a weak impact on hospital resilience. Next, this study tested the predictive relevance of the model through a blindfold procedure (Q^2). The predictive relevance of the digital technology dynamic capability model

(Q^2) for hospital resilience was 0.209. As shown in Table 6, since the value of Q^2 is greater than 0, the exogenous structure represents a good predictive relevance of the model for the endogenous latent variables, and the model has satisfactory predictive power. Meanwhile, Table 6 shows that the p-value of synergy and innovativeness of digital technology capabilities are <0.05. This is corroborated by the fact shown in Table 7: the t-value of the factor loadings of synergy and innovativeness of digital technology applications is highly significant (t-value >2.00, one-tailed). At the same time, the effects of compatibility and security are relatively weak.

Table 6: Assessment of structural model

	0.33＞R^2＞ 0.67	**F2＞0**	**Q2＞0**	**P＜0.05**
Financial Resilience	0.441 (moderate)		0.209 (medium)	
Synergy -> Resilience		0.039(moderate)		0.002
Compatibility -> Resilience		0.019 (weak)		0.080
Innovation -> Resilience		0.062(significant)		0.000
Security -> Resilience		0.000 (weak)		0.435

Resource: F2>=0.02 is small; >= 0.15is medium;>=0.35 is large (Cohen, 1999)

5.3 Hypothesis Testing

Table 7 presents the coefficient PLS path analysis results for each relationship to test the research hypotheses. Based on Hair et al. (2017), if the T-value exceeds the critical value of 1.96 ($\alpha = 0.05$) or if the p-value is less than the chosen significance level (e.g., 0.05), the null hypothesis is rejected in favour of the alternative hypothesis, indicating a significant relationship. If not, fail to reject the null hypothesis, indicating a non-significant relationship. According to the test results, the path coefficients of synergy, compatibility, innovativeness, and security of digital technology capabilities of public hospitals on hospital resilience are 0.247, 0.158, 0.343, and -0.018, respectively, which show that the synergy, compatibility, and innovation factors have a positive impact on hospital resilience, with innovativeness being the most significant. Meanwhile, compatibility has a relatively insignificant impact on hospital resilience, and security has a negative effect on hospital resilience. Digital Technology Synergy and innovation have a positive and significant linkage with public hospital resilience, leading to the accepted outcome of H1 and H3 (T-value＞1.96, P-value＜0.05). Besides, Digital

Technology Compatibility has a positive but insignificant linkage with resilience in public hospitals (T-value＜1.96, P-value＞0.05)， and security negatively affects hospital resilience, resulting in the rejection of the hypothesis H2 and H4.

Table 7: Path coefficients of the measurement model

Path	B	T-value＞ 1.96	P-value＜ 0.05	Result
H1: Digital Technology Synergy→ Hospital resilience	0.247	2.969	0.002	Supported
H2: Digital Technology Compatibility Hospital resilience	0.158	1.404	0.080	Rejected
H3: Digital Technology Innovation Hospital resilience	0.343	3.744	0.000	Supported
H4: Digital Technology Security Hospital Resilience	-0.018	0.165	0.435	Rejected

6.0 FINDING AND DISCUSSION

The test results of H_1 showed a significant positive correlation ($t = 2.969$, $p \leq 0.001$) between Digital Technology Synergy and Hospital resilience, thus supporting H1. Which verified the viewpoint of Di Vaio et al. (2023), Binci et al. (2022) and Birkie (2016). Interpretation of the study results suggests that information flow and sharing based on the synergy of digital technology help to manage decisions in an emergency. Synergistic digital technology contributes to smoother and more efficient cross-department communication in public hospitals by improving management collaboration.

The test results of H2 do not support the positive correlation between the compatibility of digital technology and hospital resilience, which is Different from the results of Fleisch et al. (2021). Although the test results show a positive correlation between the compatibility of digital technology and the hospital's risk resistance, this effect is insignificant ($t=1.404$, $P=0.080$). According to H_2, the compatibility management platform of digital healthcare systems in public hospitals can help strengthen digital business collaboration across departments, promote shared information, achieve effective decision-making and coordinated response, and identify potential risks promptly to mitigate the impacts of disturbances. However, according to the study results, this role has not been played significantly enough.

The findings indicate that the innovative capacity of digital technology applications positively impacts hospital resilience ($t=3.744$, $p=0.000$), thus supporting H_3. This verified the viewpoint of Al-Omoush et al. (2022), Baudier et al. (2023), Akpan et al. (2022), and Alvarenga et al., 2023). Innovative applications of digital technology break the boundary of traditional healthcare services, making healthcare services available and accessible at any time and geography through Internet-based applications, which help maintain the continuity of healthcare services in the event of manual service interruptions. This solution improves the hospital's adaptability and flexibility, which allows public hospitals to recover quickly from crises.

The study results of H_4 show that the correlation between digital technology security and hospital resilience has a negative effect (t=0.165, P=0.435). Which is Different with the result of Akpan et al. (2022), Paz-de-Sousa et al. (2023), Fleisch et al. (2021) and Zhang et al. (2015). According to the hypothesis of this study, in the era of digital healthcare, building security capabilities of digital technologies helps healthcare organizations strengthen the security of patients' medical information, and authorized access based on data security, storage, backup, and recovery helps to ensure the sustainability of hospital healthcare services and the availability of resources in case of emergencies. However, hospital digital technology security may lead to cumbersome processes and delayed responses. Its effect on the operational resilience of public hospitals during a crisis is not sufficiently significant in scenarios that require rapid emergency response.

7.0 CONCLUSION

This empirical study examines the mechanism of action by which digital technology applications' dynamic capabilities (compatibility, synergy, innovation, and security) affect disaster resilience in public hospitals. The study results show that synergistic capabilities of digital technology applications are significantly and positively related to hospital resilience. Hospitals strengthen digital synergy to help ensure smooth communication and effective sharing of internal and external information to reduce the impact of risky disturbances. Therefore, investing in the synergism of digital healthcare applications is of great significance to the robustness, adaptability, and flexibility of hospitals' operations under turbulent environments, which makes hospitals more capable of adapting to changes in the environment and ensuring the sustainability of healthcare service provision. The study's results also indicate that the innovative capacity of digital technology has a positive and significant impact on the hospital's resistance. This result supports the view that public hospitals should encourage the building of innovative capabilities in digital healthcare, such as the promotion and application of Internet healthcare, e-payment, Internet of Medical Things, and big data platforms to facilitate robust hospital operations, accelerate crisis recovery and flexibly respond to risks, thereby helping public hospitals to build a higher level of resilience. However, despite this study's assumption that the compatibility and security of digital healthcare can positively contribute to building resilience in public hospitals. The statistical results do not significantly support these two hypotheses.

The study results support hospital managers' decision-making (investment in synergy and innovation of digital technology) in digital technology capacity building in the digital era. However, this study still has some limitations. Firstly, the cross-sectional method used in this study only focuses on the correlation of variables at a given time point, and time series analysis methods should be used in the future to explore this field's development. Secondly, this study only focuses on the viewpoint of internal managers and staff in public hospitals by organization level study. In the future, it is necessary to enrich knowledge in this area from the perspective of external stakeholders. Thirdly, the adjusted R^2 impact of the four independent variables used is only 44.10%, indicating that other possible variables may play a role in the resilience of public hospitals. For example, variables such as strategic management, leadership, and risk control will be further evaluated in subsequent research. Fourthly, this study only investigated the relationship between the independent and dependent variables. Future research will deeply explore the relationship between each independent variable. Hoping the above limitations can inspire further research in this field.

REFERENCES

Akpan, E. E., Johnny, E., & Sylva, W. (2022). Dynamic capabilities and organizational resilience of manufacturing firms in Nigeria. *Vision: The Journal of Business Perspective, 26*(1), 48–64.

Aldrighetti, R., Zennaro, I., & Finco, S. (2019). Healthcare supply chain simulation with disruption considerations: A case study from Northern Italy. *Global Journal of Flexible Systems Management, 20*(1), 81–102.

Al-Omoush, K. S., Palacios-Marqués, D., & Ulrich, K. (2022). The impact of intellectual capital on supply chain agility and collaborative knowledge creation in responding to unprecedented pandemic crises. *Technological Forecasting and Social Change, 178*(1), 121603.

Alvarenga, M. Z., de Oliveira, M. P. V., & Oliveira, T. (2023). Let's talk about bad experiences instead of forgetting them: An empirical study on the importance of memory for supply chain disruption management. *International Journal of Production Economics, 261*(1), 108872.

Ande, R., Adebisi, B., Hammoudeh, M., & Saleem, J. (2020). Internet of things: Evolution and technologies from a security perspective. *Sustainable Cities and Society, 54*(1), 101728.

Andersen, K. N., Nielsen, J. A., & Kim, S. (2019). Use, cost, and digital divide in online public health care: Lessons from Denmark. *Transforming Government: People, Process and Policy, 13*(2), 197–211.

Araujo, R., Fernandes, J. M., Reis, L. P., & Beaulieu, M. (2023). Purchasing challenges during COVID-19: Resilience practices to mitigate disruptions in the healthcare supply chain. *Journal of Global Operations and Strategic Sourcing, 16*(2), 368–396.

Barbash, I. J., & Kahn, J. M. (2021). Fostering hospital resilience—Lessons from COVID-19. *JAMA, 326*(8), 693–694.

Baudier, P., Kondrateva, G., Ammi, C., Chang, V., & Schiavone, F. (2023). Digital transformation of healthcare during the COVID-19 pandemic: Patients' teleconsultation acceptance and trusting beliefs. *Technovation, 120*(1), 102547.

Binci, D., Palozzi, G., & Scafarto, F. (2022). Toward digital transformation in healthcare: A framework for remote monitoring adoption. *The TQM Journal, 34*(6), 1772–1799.

Binsar, F., Mursitama, T. N., Hamsal, M., & Rahim, R. K. (2025). The role of digital adoption capability on hospital performance in Indonesia moderated by environmental dynamism. *Journal of Health Organization and Management, 39*(1), 1-21.

Birkie, S. E. (2016). Operational resilience and lean: In search of synergies and trade-offs. *Journal of Manufacturing Technology Management, 27*(2), 185–207.

Cavusgil, S. T., & Deligonul, S. Z. (2025). Dynamic capabilities framework and its transformative contributions. *Journal of International Business Studies, 56*(1), 33-42.

Chin, W. W. (1998). *The partial least squares approach to structural equation modeling*. In G. A. Marcoulides (Ed.), *Modern methods for business research* (pp. 295–336). Lawrence Erlbaum Associates Publishers.

Chowdhury, M. M. H., & Quaddus, M. (2017). Supply chain resilience: Conceptualization and scale development using dynamic capability theory. *International Journal of Production Economics, 188*(1), 185–204.

Cohen, M. H. (1999). The technology-dependent child and the socially marginalized family: A provisional framework. *Qualitative Health Research, 9*(5), 654-668.

Di Vaio, A., Latif, B., Gunarathne, N., Gupta, M., & D'Adamo, I. (2023). Digitalization and artificial knowledge for accountability in SCM: A systematic literature review. *Journal of Enterprise Information Management, 37*(2), 606-672.

Donelli, C. C., Fanelli, S., Zangrandi, A., & Elefanti, M. (2022). Disruptive crisis management: Lessons from managing a hospital during the COVID-19 pandemic. *Management Decision, 60*(13), 66-91.

Ekanayake, B., Wong, J. K.-W., Fini, A. A. F., & Smith, P. (2021). Computer vision-based interior construction progress monitoring: A literature review and future research directions. *Automation in Construction, 127*(1), 103705.

Fleisch, E., Franz, C., & Herrmann, A. (2021). *The digital pill: What everyone should know about the future of our healthcare system.* Emerald Publishing Limited.

Fornell, C., & Bookstein, F. L. (1982). Two structural equation models, LISREL and PLS, applied to consumer exit-voice theory. *Journal of Marketing Research, 19*(4), 440-452.

Fornell, C., & Larcker, D. F. (1981). Evaluating structural equation models with unobservable variables and measurement error. *Journal of Marketing Research, 18*(1), 39-50.

Hair, J. F., Hult, G. T. M., Ringle, C. M., & Sarstedt, M. (2017). *A primer on partial least squares structural equation modeling (PLS-SEM)*. Sage Publications.

Hillmann, J., & Guenther, E. (2021). Organizational resilience: A valuable construct for management research? *International Journal of Management Reviews, 23*(1), 7–44.

Hundal, G. S., Thiyagarajan, S., Alduraibi, M., Laux, C. M., Furterer, S. L., Cudney, E. A., & Antony, J. (2021). Lean Six Sigma as an organizational resilience mechanism in health care during COVID-19. *International Journal of Lean Six Sigma, 12*(4), 762–783.

Ivanov, D., & Dolgui, A. (2019). New disruption risk management perspectives in supply chains: Digital twins, the ripple effect, and resileanness. *IFAC-PapersOnLine, 52*(13), 337–342.

Jin, J., Chen, Z., & Li, S. (2022). How does ICT capability affect the environmental performance of manufacturing firms? Evidence from the World Bank Enterprise survey in China. *Journal of Manufacturing Technology Management, 33*(2), 334–354.

Khin, S., & Ho, T. C. (2019). Digital technology, digital capability, and organizational performance. *International Journal of Innovation Science, 11*(2), 177–195.

Kitsios, F., & Kapetaneas, N. (2022). Digital transformation in healthcare 4.0: Critical factors for business intelligence systems. *Information, 13*(5), 1-14.

Kruk, M. E., Myers, M., Varpilah, S. T., & Dahn, B. T. (2015). What is a resilient health system? Lessons from Ebola. *The Lancet, 385*(9980), 1910–1912.

Li, Z., Xu, Z., & Sukumar, A. (2023). Digital resilience and firm internationalization: A study of Chinese listed companies. *Journal of Enterprise Information Management, 37*(5), 1479-1498.

Lisdiono, P. (2022). *Dynamic capabilities and risk management practices on enterprise resilience among Indonesian state-owned enterprises and their subsidiaries* [Unpublished doctoral dissertation]. Universiti Teknologi MARA (UiTM).

Munoz, A., Billsberry, J., & Ambrosini, V. (2022). Resilience, robustness, and antifragility: Appraising distinct organizational responses to adversity. *International Journal of Management Reviews, 24*(2), 181–187.

Paz-de-Sousa, K. M., Rosana de Araújo Oliveira, S., Alencar Sousa Macau Furtado, B. M., Ribeiro de Vasconcelos, A. L., Gomes de Medeiros, S., Cazarin, G., Soares Sampaio, A., & Ridde, V. (2023). Hospital Resilience in Three COVID-19 Referral Hospitals in Brazil. *Health Systems & Reform, 9*(2), 1-9.

Ruiz-Mallorquí, M. V., Aguiar-Díaz, I., & González-López Valcárcel, B. (2021). Arrangements with the NHS for healthcare services: do they improve the financial performance of private for-profit hospitals in Spain? *Health Economics Review, 11*(9), 1-12.

Sabahi, S., & Parast, M. M. (2020). Firm innovation and supply chain resilience: A dynamic capability perspective. *International Journal of Logistics Research and Applications, 23*(3), 254–269.

Sari, N., Omar, M., & Pasinringi, S. A. (2024). Toward hospital resilience: A qualitative study on the identification of hospital shocks during disruption era in Indonesia. *BMC Health Services Research, 24*(1), 1185.

Schweitzer, J. (2014). Leadership and innovation capability development in strategic alliances. *Leadership & Organization Development Journal, 35*(5), 442–469.

Stennett, J., Hou, R., Traverson, L., Ridde, V., Zinszer, K., & Chabrol, F. (2022). Lessons learned from the resilience of chinese hospitals to the COVID-19 Pandemic: Scoping review. *JMIRx Med, 3*(2), e31272.

Teece, D. J., Pisano, G., & Shuen, A. (1997). Dynamic capabilities and strategic management. *Strategic Management Journal, 18*(7), 509–533.

Wieland, A., & Durach, C. F. (2021). Two perspectives on supply chain resilience. *Journal of Business Logistics, 42*(3), 315-322.

World Health Organization. (2023, April 23). WHO launches new initiative to improve pandemic preparedness. *WHO.* https://www.who.int/news/item/26-04-2023-who-launches-new-initiative-to-improve-pandemic-preparedness

Yan, A., Zou, Y., & Mirchandani, D. A. (2020). How hospitals in mainland China responded to the outbreak of COVID-19 using information technology-enabled services: An analysis of hospital news webpages. *Journal of the American Medical Informatics Association, 27*(7), 991–999.

Yan, X., Li, J., Sun, Y., & Souza, R. (2023). Supply chain resilience enhancement strategies in the context of supply disruptions, demand surges, and time sensitivity. *Fundamental Research, 5*(6), 496-504.

Ye, F., Ke, M., Ouyang, Y., Li, Y., Li, L., Zhan, Y., & Zhang, M. (2023). Impact of digital technology usage on firm resilience: A dynamic capability perspective. *Supply Chain Management, 29*(1), 162-175.

Yoshikuni, A. C., Dwivedi, R., Favaretto, J. E. R., & Zhou, D. (2023). How enterprise information systems strategies-enabled strategy-making influences organizational agility: Mediated role of IT-enabled dynamic capabilities in two BRICS countries study. *Journal of Enterprise Information Management, 37*(1), 230-258.

Zhang, J., Li, H., & Zhao, H. (2025). The impact of digital transformation on organizational resilience: The role of innovation capability and agile response. *Systems, 13*(2), 1-26.

Zhang, J., Long, J., & von Schaewen, A. M. E. (2021). How does digital transformation improve organizational resilience? Findings from PLS-SEM and fsQCA. *Sustainability, 13*(20), 11487.

Zhong, S., Clark, M., Hou, X.-Y., Zang, Y., & FitzGerald, G. (2015). Development of key indicators of hospital resilience: A modified Delphi study. *Journal of Health Services Research & Policy, 20*(2), 74–82.