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Enhancing Financial Resilience in Chinese Public Hospitals: Role of dynamic capabilities

Zhang Tongtong[1], Jamaliah Said[2]*, Nor Balkish Zakaria[2], Xusheng Li[3]
**Corresponding Author:*2021225246@student.uitm.edu.my

[1] Faculty of Accounting, Universiti Teknologi Mara, Sabah branch, Malaysia,
[2]Accounting Research Institute (HICoE), Universiti Teknologi MARA, Malaysia,
[3]Department of Spinal Orthopedics, General Hospital of Ningxia Medical University, China

2021225246@student.uitm.edu.my,Jamaliah533@uitm.edu.my,norbalkish@uitm.edu.my,lixusheng101@gmail.com
Tel: +60 107699345

Abstract
The resilience of the healthcare system directly affects the quality of public life. This study investigates how dynamic capabilities in the financial management of public hospitals, including revenue diversification, cost adjustment, budget flexibility, and financial informatization, impact the resilience of public hospitals in China. An online survey of 197 hospital staff was conducted using a seven-point Likert scale, with data analyzed via SPSSAU and Smart-PLS. Findings reveal that revenue diversification and cost adjustment significantly enhance financial resilience. The research offers insights for policymakers to improve hospital resilience and contributes to existing literature on healthcare finance.
Keywords: Financial Resilience; Dynamic Capability Theory; Revenue Diversity; Cost Adjustment

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1.0 Introduction

China is the largest developing country, facing significant challenges in its public healthcare system due to evolving social structures and disease patterns. As the pillars of the public healthcare system, public hospitals are essential for health services. During the COVID-19 pandemic, the shortage of medical resources and disruption of healthcare services resulted in a deficit in over 50% of public hospitals (NHC, 2024). The World Health Organization emphasizes investing in public health resilience (WHO, 2024). Dynamic capability theory highlights the capability of the organization to sense, seize, and reconfigure the resources to respond to the crisis. Based on the dynamic capability theory, the connotations of dynamic capability and resilience are consistent, and dynamic capability is considered to cultivate organizational resilience. However, previous studies focused less on the resilience of health systems (Hamid et al., 2023) while primarily focusing on the financial resilience construction of state-owned enterprises and banks. Given the critical role of public hospitals in the healthcare system, previous studies inadequately address their resilience. While some research has explored health system resilience mechanisms, empirical financial perspectives remain limited, particularly regarding financial management capabilities under the SEM-PLS method (Tascón et al., 2023). This study aims to investigate the effects of key dynamic capabilities in financial management on the resilience of public hospitals. Based on the literature review, a comprehensive framework was established in this study to determine the critical dynamic capability of financial management in public hospitals and its effect mechanism.

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To achieve the research objective, the rest of this study is structured as follows: The second section is a literature review. The third section proposes hypotheses and a research framework; the fourth section outlines the research methods. The fifth section contains the findings and discussion, and the sixth section presents the conclusion of this study, including managerial and practical implications and limitations.

2.0 Literature review

2.1 The resilience of organizations

Resilience refers to the capability of an organization to resist, adapt, and recover from crises (Rahmani et al., 2023). Scholars have classified organizational resilience into three dimensions from the time perspective (before, during, and after): robustness, adaptability, and flexibility (Alvarenga et al., 2023). Research has found that organizations adopt key financial management measures, such as budget redundancy and revenue diversification, to maintain the organization's adaptability and operational flexibility in times of crisis. During the COVID-19 pandemic, manufacturing companies adopted various financial strategies to maintain financial stability and operational continuity. In addition, Korean scholars have extended resilience research to public health, focusing on hospitals implementing budget redundancy strategies, including expenditure adjustments, to enhance operational flexibility. However, research on the resilience of Chinese public hospitals from a financial management perspective is still limited.

2.2 Dynamic Capability Theory

The survival and development of an organization fundamentally depend on resources. However, having resources alone is insufficient to manage uncertain risks effectively (Cavallaro & Villani, 2024). The development of Dynamic Capability Theory (DCT) is based on Resource Dependence Theory and Resource-based View, which further emphasizes the ability of organizations to perceive, seize, and reconfigure resources to respond to emergencies and destructive risks based on their existing resources (Teece et al., 1997). Some scholars indicated that enhancing dynamic management capabilities helps to prevent unpredictable risks (Rahmani et al., 2023). The existing research on the critical role of organizational management capability in unforeseeable crises based on dynamic capability theory is still insufficient. In addition, the key dynamic capabilities that affect the flexibility of public hospitals need to be further explored. Therefore, based on the theory of dynamic capability, this article constructs a comprehensive dynamic capability evaluation framework to address the gap between the dynamic capability and resilience of financial management.

2.3 Dynamic capability and financial resilience in public hospitals

In the public sector, dynamic capability is crucial for measuring an organization's resilience in responding to unforeseen crises. Financial redundancy is noted to help maintain performance during economic shocks. Ansmann et al. (2021) emphasize the importance of reorganizing resources within budget limits and enhancing managerial capabilities under uncertainty. Revenue diversification has been shown to improve performance in state-owned banks, while Kazmi and Ahmed (2022) found that adjusting budget timelines enhances spending flexibility. Petry & de Mattos (2023) explored strategies for reducing variable healthcare costs through flexible structures, and Other scholars highlighted the role of financial information technology in modernizing public health organizations. Despite discussions on financial resilience in sectors like banking and government, comprehensive examination in public healthcare remains lacking. This study addresses this gap by applying dynamic capabilities theory within a financial resilience framework to explore how financial management strategies (revenue diversification, flexible budgeting, cost adjustment, and financial informatization) affect the financial resilience of public hospitals.

3.0 Hypothesis Development

Diversification is crucial for mitigating organizational operational risks and enhancing emergency management and prevention. Adem (2023) highlights that revenue diversification strengthens organizational stability while negatively impacting specific risk indicators. The correlation between revenue diversification and crises significantly affects stability assessments (Duho et al., 2023). In hospitals, revenue diversification involves generating income beyond traditional outpatient and inpatient services, reducing reliance on a single revenue stream, and spreading financial risk. Duho (2023) found that public hospitals increased alternative income during the COVID-19 pandemic, enhancing operational recovery. Future research should identify new revenue sources that support the building of financial redundancy, backup, and reserves, thereby improving operational resilience. Thus, the following hypotheses are proposed:

H1: Revenue diversification has a positive and significant effect on the financial resilience of hospitals.

Public hospitals play a crucial role in the healthcare sector by effectively utilizing public funds to enhance organizational productivity. Cost management strategies allow for the reallocation of financial resources toward priority operations by adjustments in expenditure structures, including long-term versus short-term and fixed versus variable costs (1997). By restructuring these costs, hospitals can reduce their dependence on external funding sources, such as government subsidies, while adhering to budgetary constraints. This capability to adjust expenditures within a limited budget represents a dynamic capability that enables hospitals to manage unpredictable risks while maintaining operational stability. Consequently, this study proposes the following hypotheses:

H2: Cost adjustment positively and significantly affects the hospital's financial resilience.

Flexible budgeting is a crucial dynamic management tool that allows organizations to adjust financial strategies in response to changing circumstances. Unlike static budgets, which remain fixed, flexible budgets adapt to variations in revenues and expenditures. Agyemang and Ryan (2013) found that departments prefer flexible budgets to adapt to environmental changes. This flexibility enables hospitals to respond effectively to shifting market conditions and patient needs by integrating budget redundancy, preparing them for routine operations and unexpected shocks (Lusardi et al., 2021). By employing flexible budgets, hospitals can enhance performance through dynamic resource allocation. Therefore, we propose the following hypothesis:

H3: Flexible budgeting has a positive and significant effect on improving hospital financial resilience.

Financial informatization leverages information technology to automate and enhance financial management processes (Alvarenga et al., 2023). Digital systems overcome temporal and geographical barriers, facilitating connections among departments, partners, and stakeholders, which fosters efficient collaboration through adaptable business processes. Financial information technology allows hospitals to access real-time financial data, monitor performance indicators, and identify growth opportunities (Garcia-Perez et al., 2023). It enhances hospitals' ability to adapt to changing market conditions, regulatory demands, and financial challenges by enabling data-driven decision-making. This technology application improves governance and risk management practices and mitigates financial risks. Thus, we propose the following hypothesis:

H4: Financial Informatization has a positive and significant effect on improving the financial resilience of hospitals.

The path relationships between variables are based on the above hypothesis, as shown in Figure 1.

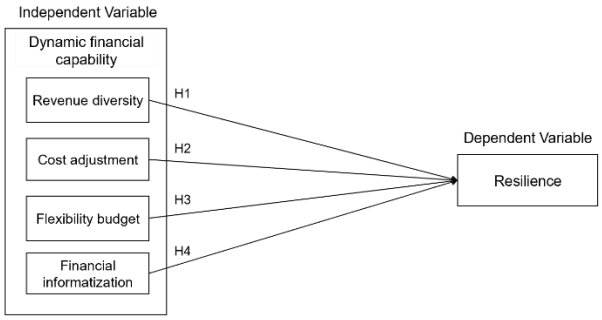

Fig. 1: The conceptual framework

4.0 Methodology

Public hospitals in China serve as a cornerstone of the public healthcare system. However, during the COVID-19 pandemic, they experienced significant revenue declines and operational disruptions. Despite these challenges, they managed to navigate the financial crisis successfully and ultimately recovered. Based on the previous study (Etikan, 2016), this study employed purposive sampling, a non-probability sampling method, to survey financial managers and staff at these hospitals. Purposive sampling was chosen because it effectively targeted specific respondents with relevant expertise. It is critical when exploring complex and context-specific issues such as financial management in public hospitals.

A structured questionnaire was developed based on existing literature to investigate the dynamic capabilities of financial management in public hospitals. Four items on income diversification were adapted from Busch and Kick (2009) and Mnasri and Abaoub (2010) to assess how financial redundancy enhances resilience. Six budget flexibility items derived from Ekholm and Wallin (2011) examined the impact of flexible budgeting on hospital performance during adverse conditions. Based on Zhang et al. (2020), five items on cost adjustment capabilities evaluated how hospitals adjust cost structures to reduce reliance on external funding. Lastly, four items on financial informatization, adapted from Hussain and Papastathopoulos (2022), assessed how it helps hospitals adapt to market conditions and financial challenges.

The questionnaire used a seven-point Likert scale, which has advantages in measuring precision and capturing a range of responses. A sample size of 150 is typically considered adequate for structural equation modeling (SEM) when there are three or more indicators per construct, as Anderson and Gerbing (1988) recommended. Given the study's design, which includes multiple constructs with multiple indicators, this sample size was deemed sufficient to ensure the reliability and validity of the results. The questionnaire was distributed online to 426 financial department managers and staff from March to May 2024, yielding 205 valid responses, corresponding to a response rate of 48.62%. This response rate exceeded the recommended minimum threshold and enhanced the study's statistical power, ensuring robust and generalizable findings.

SPSSAU is the web-based version of SPSS, which was used for demographic data analysis in this study because of its comprehensive statistical capability, which supports the reliability and robustness of the data. Smart PLS 4.1 is suitable for advanced analysis, especially in smaller sample sizes and non-normally distributed data cases. Therefore, it was utilized for model testing in this study.

5.0 Data Analysis

5.1 Demographic statistic

Table 1 presents the demographic characteristics of the respondents. Among them, 40.48% were over 40, 52.19% were employed in hospital management roles, and 60.98% worked in secondary-level hospitals or higher. Additionally, 85.85% held a bachelor's degree or higher, while 28.78% had more than ten years of experience. These statistics indicate that most respondents possess the necessary work experience, educational qualifications, and cognitive skills relevant to the research area.

Table 1. The demographic statistics

Item	Option	Frequency	Percentage (%)	Accumulate percentage (%)
1. Gender:	Male	88	42.93	42.93
	Female	117	57.07	100.00
2. Age	Below 30 years	33	16.10	16.10
	30 - 40 years	89	43.41	59.51
	41 - 50 years	62	30.24	89.76
	Above 50 years	21	10.24	100.00
3. Education:	Doctor	9	4.39	4.39
	Masters	56	27.32	31.71
	Bachelor	111	54.15	85.85
	Other	29	14.15	100.00
4. Years of service experience	Less than one year	14	6.83	6.83
	1 - 5 years	61	29.76	36.59
	5 - 10 years	71	34.63	71.22
	More than ten years	59	28.78	100.00
5. Level of your hospital	The tertiary hospital	70	34.15	34.15
	The second level	84	40.98	75.12
	The primary level	41	20.00	95.12
	Other	10	4.88	100.00
6. Position:	Dean	12	5.85	5.85
	Managers	95	46.34	52.20
	staff	90	43.90	96.10
	Other	8	3.90	100.00
Sum		205	100.0	100.00

(Source:) SPSSAU analyzed by authors

Table 2 indicates a Cronbach's α value of 0.951, demonstrating high reliability in the data. Table 3 shows a KMO value of 0.929, indicating the data's suitability for factor analysis. Both the KMO value and Bartlett's test of sphericity support the subsequent steps in the study.

Table 2.Cronbach reliability analysis

Item	Sample	Cronbach α coefficient
26	205	0.951

Table 3. KMO and Bartlett's test

KMO-value			0.929
Bartlett Sphericity Test		X2	3084.346
		df	325
		p-value	0.000

5.2 PLS Measurement model

Table 4 shows that the composite reliability (CR) values for all constructs in the model exceed 0.70, indicating strong internal consistency and reliability (Fornell & Larcker, 1984). Additionally, all constructs' average variance extracted (AVE) values are more significant than 0.50, demonstrating satisfactory convergent validity (Fornell & Larcker, 1981). The SRMR value of 0.072 confirms a satisfactory model fit, as validated by Heseler et al. (2014).

Table 4. The Reliability and convergent validity of the measurement model

	Cronbach α	CR	AVE	SRMR
SD	＞0.7	＞0.7	＞0.5	＜0.08

FR	0.808	0.813	0.567	0.072
RD	0.764	0.767	0.586	
FB	0.750	0.755	0.502	
EA	0.838	0.845	0.555	
FI	0.758	0.776	0.512	

(Source:) Hair Jr. et al. (2017), Henseler et al. (2015), Diamantopoulos and Siguaw (2006), and Henseler et al. (2014).

Table 5 demonstrates that the measurement model exhibits discriminant validity, as the cross-factor loadings exceed 0.7 and are more significant than the other factor loadings. Additionally, the difference between the factor loadings and cross-loadings exceeds 0.1. Therefore, Table 5 confirms that all components of the measurement model meet the established criteria (Chin, 1998b).

Table 5. The discriminable validity of the measurement model

	Expenditure adjustment	Flexible budget	Financial informatization	Hospital resilience	Revenue diversity
Expenditure adjustment	0.74				
Flexible budget	0.60	0.71			
Financial informatization	0.63	0.60	0.71		
Hospital resilience	0.61	0.61	0.61	0.75	
Revenue diversity	0.62	0.64	0.62	0.60	0.77

(Source:) Author calculation

5.3 The Structural measurement

Table 6 presents the findings from the structural model analysis. To assess the model's predictive power, we calculated the coefficient of determination (R^2), following the recommendations of Chin (1998b) and Ringle (2004). The R^2 value for financial resilience is 0.741, indicating high predictive accuracy (Cohen, 1988; Hair Jr. et al., 2017). Revenue diversification, flexible budgeting, and cost adjustment strongly influence financial resilience. In contrast, financial informatization shows a weaker effect (with effect sizes categorized as small for $F^2 \geqslant 0.02$, medium for $F^2 \geqslant 0.15$, and significant for $F^2 \geqslant 0.35$), as noted by Cohen (1988).

Additionally, the Q^2 value in Table 6 is more significant than zero, indicating that the exogenous constructs have sufficient predictive capability regarding the endogenous latent variables. This finding confirms that the model possesses adequate predictive power, as Hair et al. (2017) explained.

Table 6. Path coefficients of the structure model

	$R^2 > 0.67$	$F^2 > 0.02$	$Q^2 > 0$	$P < 0.05$
Hospital resilience	0.741 (moderate)		0.406 (medium)	
Revenue diversity-> Financial resilience		0.043(moderate)		0.050
Flexible budget -> Financial resilience		0.043(moderate)		0.031
Cost adjustment-> Financial resilience		0.046(moderate)		0.002
Financial informatization->Financial resilience		0.027(weak)		0.060

5.4 Hypotheses testing

Table 7 provides the PLS path analysis results, indicating each factor's positive influence on hospitals' financial flexibility. Specifically, the analysis reveals that all variables, except for financial informatization, have p-values less than 0.05, confirming their statistical significance. The results demonstrate that revenue diversification and cost adjustment positively and significantly correlate with financial resilience, supporting hypotheses H1 and H3. Conversely, while flexible budgeting and financial informatization show a positive relationship with financial resilience, this relationship is not statistically significant, leading to the rejecting hypotheses H2 and H4.

Table 7. The Structural measurement (Path correlation)

Path	β	T-value > 1.96	P-value < 0.05	Result
H1: Revenue diversity-> Financial resilience	0.209	2.592	0.005	Supported
H2: Flexible budget -> Financial resilience	0.240	1.868	0.031	Reject

H3: Cost adjustment-> Financial resilience	0.264	2.907	0.002	Supported
H4: Financial informatization->Financial resilience	0.203	1.554	0.060	Reject

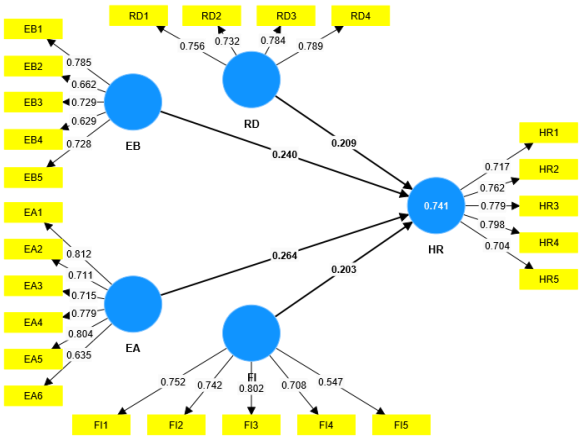

Fig. 2: The path coefficient test

6.0 Finding And Discussion

The results show that there is a positive correlation between revenue diversification and hospital resilience in public hospitals (β =0.209, t=2.592, p$\leqslant$0.05), thus supporting Hypothesis 1 (H1). This finding highlights the importance of revenue diversification in improving the financial resilience of public hospitals, which is consistent with previous studies (Adem, 2023; Duho et al., 2023). Adem (2023) believes that by diversifying revenue sources, hospitals can better guard against risks and challenges brought about by internal and external emergencies. The conclusions of this study confirm the above view and further confirm that revenue diversification can help hospitals adapt to changing conditions and develop resilience by effectively creating financial redundancy.

The analysis showed that although there was a positive correlation between flexible budgets and hospital resilience in public hospitals, it was not statistically significant (β = 0.240, t = 1.868, p = 0.06). This result contradicts Hypothesis 2 (H2). According to previous studies, budget flexibility is an important financial management measure for hospitals to cope with large expenditures during emergencies (Ekholm & Wallin, 2011). The study of Oyadomari et al. (2018) confirms that the financial redundancy created by flexible budgets contributes to organizations' emergency financial management capabilities. However, in a turbulent environment with resource shortages and service disruptions, it may be difficult for organizations to predict and provide sufficient cash flow to support budget flexibility quickly.

The test results show that cost adjustment in public hospitals has a positive impact on financial resilience (β = 0.264, t = 2.907, p $\leqslant$ 0.05), supporting Hypothesis 3 (H3). This is consistent with Liu (2024), who emphasized that high fixed costs are a key risk factor affecting the stability and sustainability of medical operations. Adjusting costs within limited budget resources provides a new strategy for organizations to cope with unforeseen shocks and overcome medical resources and service constraints. This study further proves that adjusting the cost structure, significantly increasing the proportion of variable costs, helps to mitigate unexpected challenges in a dynamic environment.

Finally, the results of Hypothesis 4 (H4) do not support the hypothesis that financial informatization of public hospitals significantly affects resilience. Although it positively impacts stable, adaptable, and flexible financial operations (β = 0.203, t = 1.554, p $\leqslant$ 0.001), it is not statistically significant. This finding contradicts the earlier studies of Alvarenga et al. (2023) and Garcia et al. (2023). Previous research by Garcia et al. (2023) suggests that financial informatization helps public medical organizations to operate sustainably during crises. However, this study notes that the construction of medical informatization requires many investments, complex processes, and authorization mechanisms, which will affect its actual role.

7.0 Conclusion

7.1 Management Implementation

In the VUCA era, resource shortages and medical service interruptions caused by frequent public health incidents pose a challenge to the financial resilience of public hospitals. As the largest developing country, China is important in global medical cooperation and emergency medical security systems. As the pillar of China's public medical system, public hospitals provide a solid guarantee for sustainable medical operations with their dynamic financial management capabilities and good resilience. The main findings of this study support that revenue diversification and cost adjustment positively impact resilience (Asif & Akhter, 2019; García-Cornejo & Pérez-Méndez, 2018; Hammudeh et al., 2020), which highlights the need for public hospitals to broaden their revenue sources and implement

proactive cost measures. In addition, cost adjustment strategies that reduce high fixed costs while increasing budget flexibility are essential to improve the adaptability of healthcare spending during unexpected disruptions. Although flexible budgets and financial informatization did not have a significant direct impact on resilience, which is contrary to previous studies (Ekholm & Wallin, 2011; Hussain & Papastathopoulos, 2022; Kass-Hanna et al., 2022; Oyadomari et al., 2018), they may still have potential indirect benefits that deserve further exploration. The findings of this study provide valuable insights for decision-makers in formulating strategies for resilience from the financial management perspective.

7.2 Limitations

This study has several limitations due to time and resource constraints. First, its cross-sectional design does not account for changes in critical factors over time. Second, the exploratory nature focuses solely on organizational-level factors, neglecting external influences. Third, comprehensive data from various public hospitals is lacking. Lastly, with an R^2 value of 0.742, further research is needed to identify additional factors affecting financial resilience beyond revenue diversification and cost adjustments. Addressing these limitations in future studies could enhance the robustness and applicability of findings in this field.

7.3 Future research suggestion

To address the above research limitation. Future research should leverage time series analysis to explore the evolution of financial management dynamic capabilities in hospitals. It is crucial to include a broader range of stakeholder perspectives, such as regulators and patients, to gain comprehensive insights. Beyond these factors, further investigation is needed to identify other influences on financial resilience apart from revenue diversification and cost adjustment. This broader approach will enhance understanding and support the development of more effective strategies for improving hospital resilience in the face of ongoing challenges.

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Paper Contribution to Related Field of Study

This study applies dynamic capabilities theory to examine the relationship between dynamic capabilities and financial resilience in public hospitals. It offers insights into the underlying mechanisms that contribute to enhancing hospital resilience. Utilizing the Structural Equation Modeling-Partial Least Squares (SEM-PLS) method, we present empirical data that inform decision-making processes related to financial resilience in public hospitals.

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