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Configuration Path and Optimization Strategy for Enhancing the Medical Services Dynamic Capability of West China Hospital Alliance in the Digital Era

XIAO Qiqiang

Doctor of Management

Supervisors:
PhD Sergio Moro, Full Professor,
ISCTE University Institute of Lisbon
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University of Electronic Science and Technology of China

December, 2025

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I declare that this thesis does not incorporate without acknowledgment any material previously submitted for a degree or diploma in any university and that to the best of my knowledge it does not contain any material previously published or written by another person except where due reference is made in the text.

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Abstract

Digital technology, as a key driver of economic development in China, has deeply penetrated the medical field and become a core engine for reforming medical service models and enhancing the dynamic capabilities of medical services, it continues to face challenges related to the insufficient responsiveness of its dynamic capabilities. Existing research has mainly examined the effects of single technological, organisational, or environmental dimensions on the dynamic capabilities of medical services, with limited systematic investigation of the combined effects of multiple interacting factors.

This study used West China Hospital Alliance hospitals as the research subjects and was based on the Technology Organisation Environment (TOE) theoretical framework. It focused on the key issues of improving the dynamic capabilities of medical services within this alliance. The technological factors included digital innovation capability and digital facility construction. The organisational factors included digital attention and digital resource supply, whereas the environmental factors included peer competition pressure and the fulfilment of medical needs. These factors were treated as preconditions influencing the dynamic capabilities of medical services. The fuzzy set qualitative comparative analysis (fsQCA) method was used to systematically explore the configuration paths leading to high dynamic capability in medical services at West China Hospital Alliance hospitals. Four configuration paths leading to high dynamic capability were identified: resource-satisfaction, competition-driven, innovation-driven, and internal- and external-dual-driven.

The theoretical contribution of this study lies in moving beyond single-dimensional analysis of medical dynamic capabilities by constructing a systematic TOE-based research framework for medical services. This approach enriches the application of TOE theory in the medical field and provides specific pathway guidance for West China Hospital Alliance hospitals to enhance the dynamic capabilities of their medical services.

Keywords: Digital transformation, medical consortium, dynamic capability of medical services, dynamic capability theory, TOE theory

JEL: M1, M2

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Resumo

A tecnologia digital é um recurso importante para impulsionar o desenvolvimento económico nacional, tendo sido largamente adotada na área da saúde. No entanto, apesar da sua adoção e de se ter tornado essencial para a reforma dos serviços na saúde, ainda é insuficiente em termos de resposta derivada do seu dinamismo. Além disso, os estudos existentes têm-se focado mais em explorar o impacto de uma única dimensão da tecnologia, organização ou ambiente na capacidade dinâmica dos serviços de saúde, sem explorar sistematicamente o impacto conjunto de fatores multidimensionais.

Baseado no quadro teórico "Tecnologia-Organização-Ambiente" (TOE), o presente estudo foca-se nos problemas centrais da melhoria dinâmica da capacidade de serviços de saúde dos hospitais aglomerados de medicina da China, considerando os seguintes fatores técnicos: capacidade de inovação digital, construção de instalações digitais; os seguintes fatores organizacionais: organização da atenção digital, fornecimento de recursos digitais; e, finalmente, os seguintes fatores ambientais: pressão de concorrência entre pares, satisfação das necessidades médicas estabelecidas como precondições que afetam a capacidade dinâmica dos serviços de saúde. O estudo adopta uma análise qualitativa comparativa de conjuntos difusos (fsQCA), bem como uma exploração sistemática para avaliar a configuração e adequação da melhoria da capacidade dinâmica dos serviços de saúde. São identificados quatro opções para o incremento da capacidade dinâmica nos serviços de saúde: recursos satisfeitos, competitivos, inovadores e internos e externos.

O valor teórico deste estudo consiste em ampliar o impacto da investigação existente na capacidade dinâmica da saúde, focada apenas numa única dimensão, para desenvolver uma estrutura de investigação sistemática de "tecnologia-organização-ambiente" para a capacidade dinâmica dos serviços de saúde, enriquecendo a teoria TOE em cenários de aplicação no campo da saúde, bem como fornecendo orientação específica para o Hospital Aglomerado de Medicina de Huaxi para melhorar a capacidade dinâmica dos serviços de saúde.

Palavras-chave: Transformação digital, comunidade médica, capacidade dinâmica dos serviços de saúde, teoria da capacidade dinâmica, teoria do TOE

JEL: M1, M2

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摘要

数字化技术作为推动我国经济发展的重要技术资源，已深入渗透医疗领域，成为医疗服务模式改革、医疗动态能力响应提升的核心引擎。尽管数字技术赋能医疗行业实现全天候高质量高效率的服务，但是医疗领域仍然面临着动态能力响应不足的挑战。再者现有研究更注重探讨技术、组织或环境的单一维度对医疗动态能力的影响，缺乏系统性的探索多维度因素协同下对医疗服务动态能力的影响。

本研究以华西医联体医院为研究对象，基于“技术—组织—环境”（TOE）理论框架，聚焦华西医联体医院医疗服务动态能力提升的核心问题，将技术因素：数字创新能力、数字设施建设；组织因素：组织数字注意力、数字资源供给；环境因素：同侪竞争压力、医疗需求满足设为影响医疗服务动态能力的前因条件，采用模糊集定形象比较分析方法（fsQCA），系统的探索影响华西医联体医院实现高医疗服务动态能力的组态路径配置。研究结果表明，医疗服务动态能力的提升并非依靠单一因素，而是源于多维度因素的协同组合，共识别 4 条高医疗服务动态能力路径：资源满足型、竞争驱动型、创新驱动型、内—外部双驱动型。

本研究的理论价值在于，突破了现有研究从单一维度对医疗动态能力影响的研究，构建了“技术—组织—环境”对医疗服务动态能力的系统研究框架，同时丰富了 TOE 理论在医疗领域的应用场景，为华西医联体医院提升医疗服务动态能力提供了具体的路径指导。

关键词：数字化转型，医联体，医疗服务动态能力，动态能力理论，TOE 理论

JEL: M1, M2

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Acknowledgements

As the years pass by, my several-year doctoral journey is drawing to a close. Looking back on this journey filled with exploration and perseverance, confusion and growth, my heart is full of gratitude.

First and foremost, I would like to express my deepest respect and sincere thanks to my supervisor, professor Sergio Moro and professor XIAO Yangao. From the conception of the thesis topic, the construction of the research framework, to the improvement of the theoretical model and the advancement of empirical analysis, every key node cannot do without the careful guidance of my supervisor. The supervisor's profound academic accomplishment, rigorous scholarly attitude, broad research perspective and pragmatic spirit of academic inquiry not only pointed out the direction for my research, but also set a benchmark for me on the path of academic exploration. In daily communication, the supervisor's words and deeds have been like spring breeze and rain, teaching me not only how to delve into academic research, but also how to behave in life. This kindness of the teacher will benefit me for a lifetime.

I am grateful to all the senior brothers, senior sisters, junior brothers and junior sisters in the research group. When I encountered bottlenecks in scientific research, you generously shared your research experience and ideas; during the thesis writing process, you patiently put forward revision suggestions and gave me a lot of inspiration; in life, your company and encouragement made the boring scientific research time full of warmth and joy. The days of moving forward side by side with you are precious memories in my doctoral career.

I would like to thank my family and relatives. You are my strongest backing, always giving me unconditional support and understanding. When I stayed up late for research and felt anxious and confused about difficulties, it was your care and tolerance that dispelled my fatigue and gave me the courage and strength to persist. Your silent dedication is the greatest confidence for me to wholeheartedly engage in academic research, and I will always keep this deep friendship in my heart.

I am grateful to all the experts and professors who participated in the review and defense of this thesis. Amidst your busy schedules, you carefully reviewed the thesis and put forward many constructive opinions and suggestions, enabling me to identify the shortcomings in the research and improve them, thereby significantly enhancing the quality of the thesis. Your

rigorous academic attitude and professional academic insights have inspired me deeply.

I would like to thank ISCTE and UESTC for providing me with an excellent academic platform and a strong scientific research atmosphere. I also thank all the teachers of the college for their support and help in curriculum teaching, scientific research management and other aspects, which have created good conditions for my academic growth.

Finally, I would like to thank myself for my unremitting efforts during this doctoral career. Thank you for not shrinking back in difficulties and still persisting in confusion. The knowledge accumulated, the will tempered and the abilities cultivated during this journey will become valuable assets in my future life. The road ahead is long. I will carry this gratitude and gain, continue to keep my feet on the ground, forge ahead, and write a more meaningful chapter in the path of academic and life.

致谢

时光荏苒，数载博士求学生涯即将落幕。回首这段浸透着探索与坚守、交织着困惑与成长的旅程，心中满是感恩。

首先，我谨向我的导师 Sergio Moro 教授和 XIAO Yangao 教授致以最诚挚的敬意与最衷心的感谢。从论文选题的酝酿、研究框架的搭建，到理论模型的完善与实证分析的推进，每一个关键节点都离不开导师的悉心指导。导师深厚的学术素养、严谨的治学态度、开阔的研究视野与求真务实的治学精神，不仅为我的研究指明了方向，更让我在学术探索的道路上树立了标杆。在日常交流中，导师的言传身教如春风化雨，既教会我如何深耕学术，也引导我如何为人处世，这份师恩将让我受益终身。

感谢师门的各位师兄师姐、师弟师妹。在科研遇到瓶颈时，你们毫无保留地分享研究经验与思路；在论文撰写过程中，你们耐心提出修改建议，给予我诸多启发；在生活中，你们的陪伴与鼓励让枯燥的科研时光多了温暖与欢笑。与你们并肩前行的日子，是博士生涯中珍贵的回忆。

感谢我的家人与亲友。你们是我最坚实的后盾，始终给予我无条件的支持与理解。在我为研究熬夜奋战、为难题焦虑迷茫时，是你们的关爱与包容驱散了我的疲惫，给予我坚持下去的勇气与力量。你们的默默付出，是我能够心无旁骛投身学术研究的最大底气，这份深情厚谊我将永远铭记于心。

感谢参与本论文评审与答辩的各位专家教授。你们在百忙之中对论文进行了细致的审阅，提出了诸多富有建设性的意见与建议，使我得以发现研究中的不足并加以完善，让论文的质量得到了显著提升。你们严谨的学术态度与专业的学术见解，让我深受启发。

感谢里斯本大学学院和电子科技大学为我提供了优良的学术平台与浓厚的科研氛围，感谢学院的各位老师在课程教学、科研管理等方面给予的支持与帮助，为我的学术成长创造了良好的条件。

最后，感谢这段博士生涯中不懈努力的自己。感谢那个在困境中未曾退缩、在迷茫中依然坚守的自己。这段旅程所积累的知识、锤炼的意志与培养的能力，将成为我未来人生道路上宝贵的财富。前路漫漫，我将带着这份感恩与收获，继续脚踏实地、砥砺前行，在学术与人生的道路上书写更有意义的篇章。

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Contents

Chapter 1: Introduction 1
1.1 Research background 1
1.2 Problem statement 5
1.3 Research objectives 7
1.4 Research questions 8
1.5 Research methods 8
1.5.1 Research approach 8
1.5.2 Research methodology 10
1.6 Chapter arrangement 11
Chapter 2: Literature Review 13
2.1 Concept and classification of medical consortia 13
2.1.1 Definition of concepts 13
2.1.2 Characteristics and classification of medical consortia 13
2.2 Implementation model of medical consortium 15
2.2.1 The Chinese model 15
2.2.2 Other modes 21
2.3 Dynamic capability theory 24
2.3.1 Concept and theoretical development 24
2.3.2 Characteristics and influencing factors 29
2.3.3 The core logical analysis of dynamic capability theory 32
2.3.4 The research context of dynamic capability 33
2.3.5 Research on the dimensions and measurement of dynamic capability 35
2.3.6 Research on the antecedents of dynamic capabilities 38
2.3.7 The impact of dynamic capabilities on the competitive advantage of enterprises 40
2.3.8 Dynamic capabilities in the field of medical services 44
2.4 Theory of “technology organization environment” 48
2.4.1 Concept and theoretical development 48
2.4.2 Technical factors and dynamic capabilities 52
2.4.3 Organizational factors and dynamic capabilities 54

2.4.4 Environmental factors and dynamic capabilities 55
2.5 Literature review 55
Chapter 3: Research Design 59
3.1 Methodology 59
3.2 Research object selection 60
3.3 Variables measurement 61
3.4 Pilot test 70
3.4.1 Item testing and pre research 70
3.4.2 Pilot test factor load analysis 71
3.4.3 Deviation analysis of the standard method for pilot testing 73
3.4.4 Internal consistency analysis of pilot testing 73
3.5 Revised scale 76
3.5 Data collection and sample characteristics 80
3.6 Chapter summary 81
Chapter 4: Configuration Analysis of the Dynamic Capability of Medical Services in West China Hospital Alliance 83
4.1 Reliability and validity 83
4.2 Common method deviation 84
4.3 Data calibration and descriptive statistical analysis 84
4.4 Analysis of necessity conditions 87
4.5 FsQCA configuration analysis 87
4.5.1 FsQCA parameter settings 87
4.5.2 Antecedent condition configurations of high dynamic capability of medical services 90
4.5.3 Summary of results 91
4.6 Robustness test 92
4.6.1 Adjustment of calibration anchor points 92
4.6.2 Adjust consistency threshold 94
4.6.3 Adjusted frequency cutoff 96
4.6.4 Adjustment of PRI consistency threshold 98
4.7 Chapter summary 100
Chapter 5: Strategies for Enhancing the Dynamic Capabilities of Medical Services in West China Hospital Alliance 101
5.1 Summary of configuration pathways 101
5.1.1 Configuration and case examples of the resource satisfaction type 101

5.1.2 Configuration and case examples of the competition-driven type 102
5.1.3 Configuration and case examples of the competition-driven type 104
5.1.4 Configuration and case examples of the internal and external dual-driven type 105
5.2 A compendium of strategies to enhance the dynamic capabilities of medical services in the West China Hospital Consortium 106
5.2.1 Targeted allocation of digital resources based on medical demands 106
5.2.2 Establishing a multi-dimensional evaluation and optimisation system for demand–resource matching 109
5.2.3 Gradual iteration of medical infrastructure 110
5.2.4 Dynamic monitoring of external competitive pressure 113
5.2.5 Adapting infrastructures around digital innovation needs 114
5.2.6 Learning and improvisation of internal management skills in external competition 116
5.3 Chapter summary 117
Chapter 6: Conclusion and Discussion 119
6.1 Research findings 119
6.2 Research contributions 122
6.2.1 Theoretical contributions 122
6.2.2 Practical implications 123
6.3 Limitations and prospects 125
Bibliography 127
Annex: Questionnaire 137

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List of Tables

Table 1.1 Medical and health service system 2
Table 1.2 Ranking of large hospitals in China 3
Table 1.3 Ranking of science and technology values (STEM) in Chinese hospitals/departments 4
Table 3.1 Dependent variable measurement items 62
Table 3.2 Independent variable measurement items 67
Table 3.3 Load analysis of pilot test factors 72
Table 3.4 Internal consistency analysis of pilot testing 73
Table 3.5 Revised scale 76
Table 3.6 Sample features 80
Table 4.1 Reliability and validity 84
Table 4.3 Results of necessity condition analysis 87
Table 4.4 Configuration analysis results of high dynamic capability of medical services 88
Table 4.5 Configuration analysis results of high dynamic capability of medical services 91
Table 4.6 Robustness test results following calibration anchor adjustment 93
Table 4.7 Robustness test results following adjustment of the frequency cutoff to 1 94
Table 4.8 Robustness test results following adjustment of the frequency cutoff to 1 96
Table 4.9 Configuration analysis results of high dynamic capability of medical services using an adjusted PRI consistency threshold of 0.65 98
Table 5.1 Configuration analysis results of high dynamic capability of medical services 101
Table 6.1 Research problems and conclusions of this study 119

[This page is deliberately left blank.]

List of Figures

Figure 1.1 Research framework diagram 9
Figure 2.1 Management model of Xishan Medical Consortium of Zhongda Hospital 17
Figure 2.2 Governance structure of West China Hospital Leading Medical Consortium 19
Figure 2.3 West China Hospital Leading Medical Consortium management model 20
Figure 2.4 Research framework diagram 57

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Abbreviations

Abbreviation	Full name
TOE	Technology Organization Environment
fsQCA	Fuzzy Set Qualitative Comparative Analysis
WHO	World Health Organization
KP	Kaiser Permanente
HMO	Health Maintenance Organization
PHR	Personal Health Record
NHS	National Health Service
RHS	Reginal Health System
SH	Singapore Health Services
NHG	National Healthcare Group
NUHS	National University Health System
HCS	Health Corporation of Singapore
IT	Information Technology
RBV	resource-based view
ICT	Information and Communications Technology
KMS	Knowledge Management System
DC	Dynamic Capabilities
DIC	Digital innovation capability
DID	Digital infrastructure development
MDS	Medical demand satisfaction
PCP	Peer competition pressure
ODC	Organizational Digital concern
DRS	Digital resources supply
CITC	Corrected Item-Total Correlation
AI	Artificial Intelligence
PRI	Proportional Reduction in Inconsistency

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Chapter 1: Introduction

This chapter introduces the background, problem statement, and objectives of the research. It then discusses the research questions, research methods, data, paper outline, and structural arrangement.

1.1 Research background

In 2009, China began a new round of reforms of the medical and health system, introducing multiple measures and policy objectives, including encouraging doctors to practice at various locations, establishing regional medical consortia (hereinafter referred to as medical consortia), and gradually achieving hierarchical diagnosis and treatment. However, due to a severe shortage of medical personnel and significant disparities in professional competence, diagnostic and treatment standards, the rapid development of medical consortia has only partially met public demand for high-quality medical resources. At the same time, the contradictions caused by the siphoning of medical resources, including funds, talent, and sources of disease, have not been substantially resolved. These problems include difficulty in accessing care, high medical costs, long waiting times, and short consultation times. The promotion of hierarchical diagnosis and treatment remains difficult, and the effectiveness of hierarchical diagnosis and treatment, as well as the construction of medical consortia, is difficult to evaluate. Public satisfaction with medical services remains relatively low, conflicts between doctors and patients persist, and professional burnout among medical staff is evident. The medical and health service system is shown in Table 1.1.

Table 1.1 Medical and health service system

Field	Indicator	Unit	2015	2016	2017	2018	2019	2020 (the 13th Five-year Plan)
Medical and health service system	Number of beds per thousand people	a	5.11	5.24	5.57	5.86	6.3	<6
	Number of practicing (assistant) physicians per thousand people	person	2.22	2.39	2.53	2.64	2.77	>3.15
	Registered nurses per thousand people	person	2.37	2.61	2.79	2.96	3.18	>3.3
	Number of general practitioners per 10000 people	person	1.38	1.55	1.89	2.26	2.61	>2.8
	Proportion of social medical beds in the total number of hospital beds	%	19.4	21.8	24.4	25.9	27.5	>30

As one of the leading hospitals with strong scientific research and medical capabilities and high management efficiency in Sichuan Province and the central and western regions of China, West China Hospital of Sichuan University, hereinafter referred to as West China Hospital, has led multiple prefecture-level and county-level hospitals in Sichuan Province for more than a decade. It has adopted the practice of dispatching medical and executive teams to improve medical service delivery and management capacity within member hospitals. At the same time, a two-way referral model has been established with community medical institutions, gradually forming a chimeric medical consortium. This model has significantly improved the overall medical service levels in Sichuan Province and has largely met public demand for high-quality medical resources. In recent years, with the rapid development of emerging technologies, including 5G, artificial intelligence (AI), big data, and the Internet of Things (IoT), together with their application in the medical sector, the development of medical consortia has further accelerated, and large-scale medical consortia and medical groups have emerged in various regions of the country.

According to national hospital rankings published over the past decade by the Hospital Management Research Institute of the Chinese Health Commission and Fudan University, expert evaluations were conducted based on disciplinary reputation and research strength. West China Hospital has ranked second nationwide for ten consecutive years, after Peking Union Medical College Hospital. At the same time, as a national-level medical information research centre, the Institute of Medical Information of the Chinese Academy of Medical Sciences regards the provision of information services for national medical technological innovation as a core mission. By utilising extensive information resources and evaluation tools and leveraging multidisciplinary research teams, the Science and Technology Index (STEM) of Chinese hospitals and medical schools is released annually. West China Hospital of Sichuan University has ranked first in the comprehensive evaluation for eight consecutive years, as shown in Table 1.2 and Table 1.3.

Table 1.2 Ranking of large hospitals in China

Comprehensive Ranking	Hospital	Reputation weight	Research weight	Total Score
1	Peking Union Medical College Hospital, Chinese Academy of Medical Sciences	80.000	15.826	95.826
2	West China Hospital of Sichuan University	64.326	20.000	84.326
3	Chinese People's Liberation Army General Hospital	60.182	15.249	75.431
4	Ruijin Hospital Affiliated to Shanghai Jiao Tong University	30.843	13.122	43.965

	School of Medicine			
5	Fudan University Affiliated Zhongshan Hospital	26.869	14.071	40.940
6	The First Affiliated Hospital of Sun Yat sen University	25.998	14.490	40.488
7	Air Force Medical University Xijing Hospital	28.380	9.712	38.092
8	Tongji Hospital Affiliated to Tongji Medical College, Huazhong University of Science and Technology	23.059	13.377	36.436
9	Fudan University Affiliated Huashan Hospital	23.493	10.619	34.112
10	Peking University First Hospital	19.810	10.687	30.497
11	Peking University Third Hospital	20.985	9.397	30.382
12	Huazhong University of Science and Technology Tongji Medical College Affiliated Union Hospital	17.530	12.647	30.177
13	Peking University People's Hospital	14.918	12.680	27.598
14	The First Affiliated Hospital of Zhejiang University School of Medicine	13.279	12.923	26.202
15	The First Affiliated Hospital of China Medical University	13.915	11.993	25.908

Table 1.3 Ranking of science and technology values (STEM) in Chinese hospitals/departments

Sort	Hospital	Technological output	Academic impact	Technological conditions	Magnitude
1	West China Hospital of Sichuan University	64.72	18.80	16.48	100
2	Peking Union Medical College Hospital, Chinese Academy of Medical Sciences	37.67	18.05	13.78	69.5
3	Fudan University Affiliated Zhongshan Hospital	29.73	14.06	10.45	54.24
4	The First Affiliated Hospital of Zhejiang University School of Medicine	24.07	13.74	13.01	50.82
5	Tongji Hospital Affiliated to Tongji Medical College, Huazhong University of Science and Technology	27.38	12.56	10.42	50.36
6	Cancer Hospital of Chinese Academy of Medical Sciences	22.88	16.18	9.88	48.94
7	Peking University Third Hospital	24.71	12.18	11.23	48.12
8	Ruijin Hospital Affiliated to Shanghai Jiao Tong University School of Medicine	20.68	13.27	12.37	46.32
9	Huazhong University of Science and Technology Tongji Medical College Affiliated Union Hospital	27.37	12.01	6.85	46.23
10	Xiangya Hospital of Central South University	28.64	7.99	9.14	45.77
11	Sun Yat sen University Cancer	22.15	12.68	8.22	43.05

12	Prevention and Treatment Center Peking University First Hospital	21.18	11.38	9.85	42.41
13	Fudan University Affiliated Huashan Hospital	17.69	14.85	9.55	42.09
14	The Ninth People's Hospital Affiliated to Shanghai Jiao Tong University School of Medicine	19.33	12.66	8.64	40.63
15	Fuwai Hospital, Chinese Academy of Medical Sciences	14.67	14.33	10.14	39.14
16	Renji Hospital Affiliated to Shanghai Jiao Tong University School of Medicine	21.95	9.66	7.06	38.67
17	Peking University People's Hospital	20.29	9.76	7.91	37.96
18	The Second Affiliated Hospital of Zhejiang University School of Medicine	19.62	11.13	7.09	37.84
19	The First Affiliated Hospital of Nanjing Medical University	21.39	9.62	6.53	37.54
20	Wuhan University People's Hospital	28.21	5.44	2.73	36.38

Medical consortia continue to play an important role in deepening healthcare reform, guiding the effective allocation of high-quality medical resources, and enhancing the overall efficiency of the medical service system. The organisational form and operational mode of medical consortia have shown a diversified trend, and various studies have been conducted both domestically and internationally on the development of dynamic capabilities of hospitals within the medical consortium model.

With the continuous improvement of information infrastructure and the level of big data in China, particularly in Sichuan Province, the medical field in Sichuan, including leading hospitals such as West China Hospital, has gradually entered the era of big data. Through the collection, mining, analysis, and application of various data on a continuous basis, support is provided for hospital management decisions. This is especially evident in data management and the application of data across medical institutions within the medical consortium, which has greatly improved operational efficiency and enabled hospitals to develop dynamic capabilities. Research on data-driven development of dynamic capabilities in medical services has also become an important basis for evaluating and assessing the implementation effectiveness of medical consortia at West China Hospital, dynamically adjusting management strategies, and guiding management decisions.

1.2 Problem statement

In the context of data-driven development, the healthcare industry faces numerous challenges,

all of which relate to the dynamic ability to deliver high-quality, efficient medical services (Aboelmaged & Hashem, 2018). Against the backdrop of rapid digital technology development and the explosive growth of medical data, determining how digital technologies can be used efficiently to optimise medical service processes and enhance service capability and precision has become an urgent issue in the healthcare sector (Gopal et al., 2019). Furthermore, patient demand for medical services continues to increase. In addition to seeking high-quality services, patients also expect more timely service experiences, which drives the healthcare industry to enhance its dynamic service capabilities (Al-Jaroodi et al., 2020). The dynamic capability of medical services refers to the ability of healthcare organisations to rapidly adapt, integrate, and redistribute internal and external resources within a rapidly changing market environment (Agwunobi & Osborne, 2016).

As a medical consortium with significant regional influence, the West China Hospital Alliance hospitals enhance the dynamic capabilities of medical services, optimise the allocation of regional medical resources, and promote the efficient sharing and collaboration of high-quality medical resources (J. S. Zheng et al., 2025). The quality and efficiency of medical services provided by the West China Hospital Alliance are directly related to the health and well-being of patients in the region.

This study is based on the Technology Organisation Environment (TOE) theory and explores pathways to improve the dynamic capabilities of hospital medical services driven by data across the TOE dimensions. At the technological level, digital technology is a key driver of enhanced capabilities in the healthcare industry (Basile et al., 2023). The widespread application of digital technology and devices in the medical field provides an essential foundation for hospitals to improve medical service capabilities (Krishnamoorthy et al., 2023). At the organisational level, resources are a fundamental support for enhancing dynamic capabilities within the healthcare sector (Loureiro et al., 2023). At the environmental level, environmental conditions directly drive adjustments in dynamic capabilities within the healthcare industry (Menachemi et al., 2011). Based on TOE theory and the integrated perspective of technology, organisation, and environment within a data-driven context, improvement in service dynamic response capability requires a coordinated combination of these three dimensions (Abdurrahman et al., 2024). The core of dynamic capability lies in organisational agility to adapt, integrate, and reallocate internal and external resources in rapidly changing environments, in which technology serves as the tool, the organisation as the carrier, and the environment as the guide (Steininger et al., 2022). Therefore, within data-driven contexts, TOE factors cannot independently exert complete effects on the dynamic capabilities

of medical services. The improvement mechanism instead reflects the combined influence of TOE.

Although the TOE theory has been widely applied across multiple fields, its application in the medical sector remains limited, particularly in research on the dynamic capabilities of medical services within the West China Hospital Alliance. Few studies have examined the collaborative mechanisms of medical service dynamic capabilities from an integrated perspective of the TOE dimensions. Most existing research adopts single-perspective approaches. Some studies focus solely on digital technologies in medical diagnosis and analyse the influence of electronic medical records, enterprise resource planning systems, and IoT wearable medical devices on healthcare integration processes and dynamic capabilities such as quality, agility, and responsiveness (Chakravorty et al., 2020). Other studies examine dynamic capabilities from organisational perspectives only, investigating their presence within public health sector organisations and analysing how organisational capabilities are developed to sustain performance levels (Loureiro et al., 2023).

Therefore, this study focuses on how the West China Hospital Alliance hospitals can improve the dynamic capabilities of medical services within a data-driven context. The study examines 116 Chinese and Western medicine joint venture hospitals as the research sample, and selects six antecedent factors, including technological dimension factors (digital innovation capability, digital facility construction), organisational dimension factors (organisational digital attention, organisational resource supply), and environmental dimension factors (medical demand satisfaction, peer competition pressure). Using fuzzy set qualitative comparative analysis (fsQCA), this study explores configuration pathways that enable improvements in dynamic capabilities in West China Medical joint venture hospitals. Within the data-driven context of Xi, a systematic research framework for analysing dynamic capabilities of medical services is constructed, and pathway guidance is provided to support the enhancement of dynamic capabilities in hospitals participating in the West China Hospital Alliance.

1.3 Research objectives

The overall objective of this study is to investigate strategies for enhancing and optimising the dynamic capabilities of medical services in West China Hospital Alliance hospitals under a digital background. The study explores technological factors, including digital innovation capability and digital facility construction within the TOE framework. It also examines organisational factors, including organisational digital attention and organisational resource

supply, as well as environmental factors, including medical demand satisfaction and peer competition pressure. Together, these six factors influence the configuration mechanisms and pathways underlying dynamic capability development in medical services across West China Hospital Alliance hospitals. Based on the overall objective, the following specific objectives are established to guide the research:

1. To explore the influencing factors affecting the dynamic capabilities of medical services in West China Hospital Alliance hospitals under a digital background, and to establish a theoretical model.

2. To examine the configuration pathways that promote the dynamic capabilities of medical services in West China Hospital Alliance hospitals.

3. To develop strategies for enhancing the dynamic capabilities of medical services in West China Hospital Alliance hospitals based on configuration analysis and empirical cases.

1.4 Research questions

To achieve the overall objectives, the following research questions were formulated to guide the study.

RQ1. What are the influencing factors of the dynamic capabilities of medical services in West China Hospital Alliance hospitals?

RQ2. What are the configuration pathways for improving the dynamic capabilities of medical services in West China Hospital Alliance hospitals from a TOE perspective?

RQ3. What strategies can be adopted to enhance the dynamic capabilities of medical services in West China Hospital Alliance hospitals?

1.5 Research methods

1.5.1 Research approach

The research approach of this study follows a logical sequence: identifying problems, conducting theoretical research, performing empirical analysis, and proposing countermeasures. The West China Hospital Alliance of Sichuan University was selected as the empirical research base for the following reasons. The geographical, population, and economic distribution characteristics of Sichuan Province are similar to those of China as a whole, yet a significant imbalance persists in the distribution of medical resources across the province. Therefore, using

Sichuan Province as the research area has representative significance. Given the time lag in policy implementation, several member hospitals that joined the West China Hospital Alliance in the early stage from 2015 to 2016 were selected as sample hospitals, including hospitals G, Z, and J.

By integrating theoretical and empirical research, as well as subjective interviews and objective evaluations, a comprehensive, systematic research framework for enhancing dynamic capabilities was developed. This provides empirical evidence to support the development of medical consortia in Sichuan Province and nationwide. The specific research framework is shown in Figure 1.1.

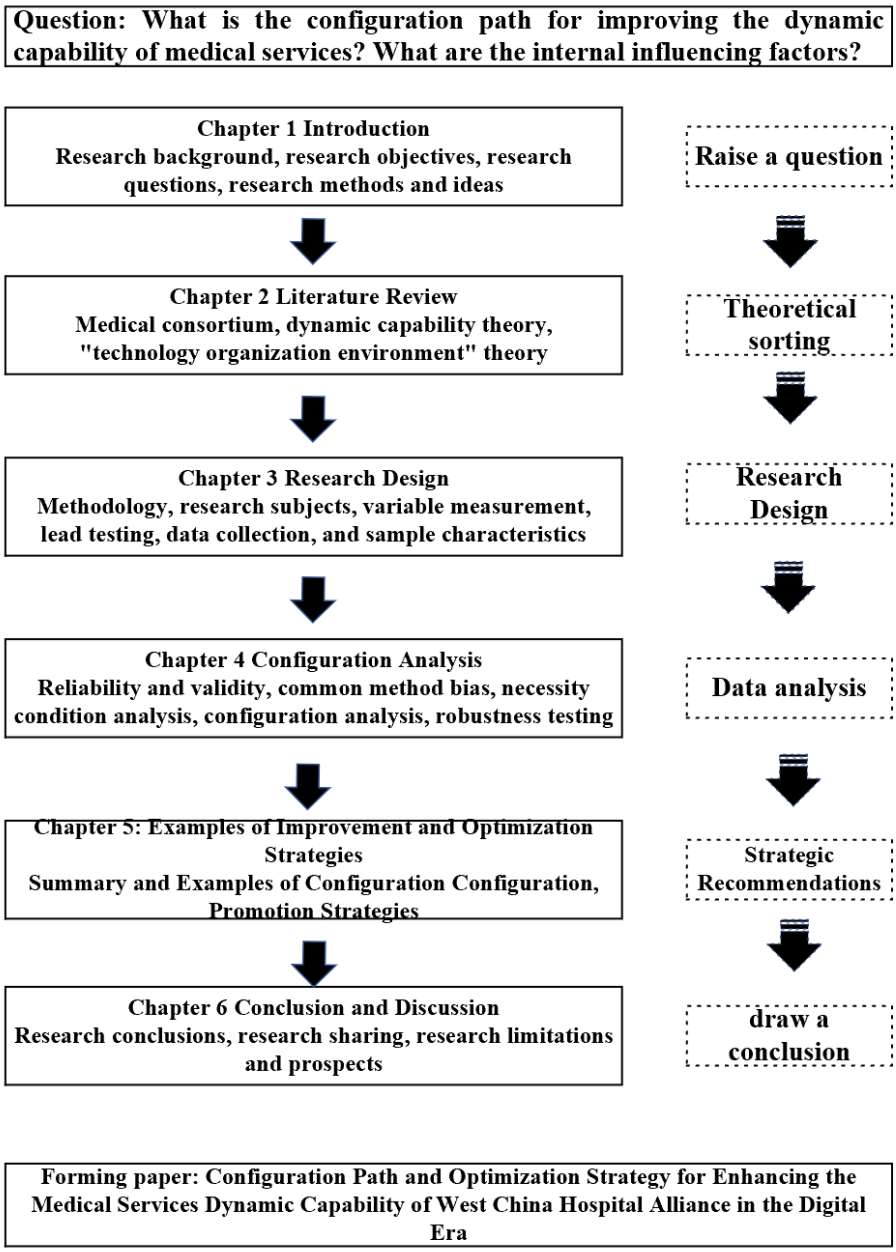


Figure 1.1 Research framework diagram

1.5.2 Research methodology

(1) Literature analysis and field research

By reviewing a large body of Chinese and foreign literature, collecting policy documents and reports from national and provincial health commissions on medical consortia, analysing and summarising the development status, experiences, and operational models of medical consortia both domestically and internationally, corresponding theoretical support was obtained. Through on-site research and interviews with leading hospitals, member units, and key managers within medical consortia, a comprehensive understanding of their implementation was achieved.

By examining relevant literature on dynamic capabilities, descriptive conclusions regarding hospital dynamic capabilities were drawn. Directions and related issues for further research into dynamic capability improvement were identified.

(2) fsQCA method

fsQCA is a method for deriving analytical summaries from case-related data and establishing logical relationships among combinations of causal conditions and outcome variables (Mendel & Korjani, 2013). The application of fuzzy set theory and Boolean logic has solved the limitations related to binary variables in exact set qualitative comparative analysis (CSQCA), and subsequently proposed the fsQCA method (Xie et al., 2016). The fsQCA method has been widely applied in fields including strategic and organisational research, data science, and learning analytics (Pappas & Woodside, 2021). This method shows particular strengths in identifying combinations of conditions that lead to the absence of outcomes, as well as positive and negative consequences (Kumar et al., 2022). The primary focus of this study is to examine how West China Hospital Alliance hospitals can enhance their dynamic capabilities in medical services. As the synergistic effects of multiple factors influence improvements in dynamic capabilities and may be achieved through different pathways, this study applies the fsQCA method to explore configuration paths for enhancing dynamic capabilities in medical services and to provide corresponding decision-making recommendations.

(3) Empirical research

Based on theoretical analysis, evaluation indicators, and evaluation methodology models, this study selected several member units of the West China Hospital Medical Consortium of Sichuan University as empirical research objects. Relevant data for the research questions were obtained through institutional surveys and questionnaire-based investigations. An empirical analysis was conducted to verify the effectiveness and feasibility of the constructed dynamic

capability indicator system and the evaluation methodology model. Practical issues were also examined to provide a theoretical basis for promoting the healthy and sustainable development of medical consortia.

1.6 Chapter arrangement

This study is divided into six chapters:

Chapter 1 introduces the study's main content and provides an overview of the entire text. This chapter includes the research background, problem statement, research objectives, research ideas, methods, research contributions, and the paper's structure.

Chapter 2 presents a comprehensive literature review of the variables in the research framework. This chapter covers key concepts related to medical consortia, dynamic capability theory, and TOE theory.

Chapter 3 describes the research methodology, including the selection of research subjects, the measurement of variables, pilot testing procedures, data collection, and sample characteristics.

Chapter 4 reports the data analysis and configuration results. This chapter includes reliability and validity testing of questionnaire data, standard method bias testing, calibration, and descriptive statistical analysis, necessary condition analysis, and fsQCA configuration analysis to identify antecedent condition configurations associated with high dynamic capability in medical services. Robustness testing was conducted by adjusting calibration anchor points, consistency thresholds, frequency cut-offs, and proportional reduction in inconsistency (PRI) values.

Chapter 5 presents the case study and optimisation strategies for enhancing the dynamic capabilities of medical services in West China Hospital Alliance hospitals. This chapter includes the induction of antecedent condition configurations, case analyses of dynamic capability improvement within the West China Hospital Alliance, and strategy development for promoting medical service dynamic capabilities.

Chapter 6 discusses the research findings and presents the conclusions and recommendations. This chapter outlines the theoretical and practical contributions of the study, examines its impact on disciplinary knowledge, and addresses its limitations and directions for future research.

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Chapter 2: Literature Review

The first chapter elaborates on the background of the research question studied in this study. Including research objectives, research questions, research ideas, and methods. This chapter reviews relevant literature, covering the concepts, classifications, characteristics, and implementation models of medical consortia. This paper explores the concepts, characteristics, and influencing factors of dynamic capabilities, as well as the concept and development of the "technology organization environment" theory, and how technological, organizational, and environmental factors affect dynamic capabilities.

2.1 Concept and classification of medical consortia

2.1.1 Definition of concepts

Medical consortia play a core role in the integration of China's healthcare service system, with similar functional concepts worldwide called "Integrated Healthcare System" and "Integrated Care Organization", both of which belong to the broader category of "integrated medicine". According to the definition of the World Health Organization, integrated medicine is a strategic measure to coordinate and arrange medical resources, implement a continuous and integrated service model for patients, with the aim of improving health benefits and reducing economic costs. When creating the global health governance system, the World Health Organization (WHO) fully recognized the value of the integrated healthcare service model and believed that it was an important way to promote the modernization of the international healthcare system. In recent years, the construction of medical consortia in China has been continuously deepening, and significant achievements have been made in various aspects such as institutional scale, operation mode, and functional expansion. At present, there is no unified and authoritative framework for defining medical consortia.

2.1.2 Characteristics and classification of medical consortia

Z. G. Zhu (2013) believes that medical consortia are alliances or medical groups formed by the organic integration of medical institutions of different categories and levels within a certain regional scope. This type of consortium has the characteristics of shared responsibility and

shared benefits. Within this medical consortium, patients can enjoy convenient and high-quality services such as two-way referral between primary hospitals and higher-level hospitals, mutual recognition of examination results, expert community consultations, and remote consultations. W. J. Ren (2014) believes that a medical consortium is a medical service organization led by one or several large hospitals, which vertically or horizontally integrates several small and medium-sized hospitals, community health service centers, and other institutions through trusteeship, cooperation, mergers, etc., with regional health planning as the core, providing full process services such as medical treatment, preventive care, and health consultation for the population in the region. W. W. Du et al. (2015) explained that a medical consortium is a joint organization of medical institutions formed by different levels and categories of medical institutions in urban areas, counties, cities and counties, and provinces with cross administrative and cross asset ownership relationships. Its purpose is to promote the vertical flow of resources within the consortium, promote the sinking of high-quality medical resources, and enhance the capacity of grassroots medical services. Huang et al. (2016) believes that medical consortia, with high-level medical institutions as the leader and vertically extending to the bottom within a certain region, integrate several low-level medical institutions to become medical consortia. Under the guidance of the government, medical consortia can cover residents in a certain area, form a standardized and orderly medical treatment system, achieve the goal of cost control, and ultimately solve the problems of difficult and expensive medical treatment. Han (2017) study pointed out that medical consortia, in a broad sense, refer to the rational utilization of limited accessible resources, the redistribution of different medical resources within the same region, and the satisfaction of different needs of patients at different levels; Narrowly speaking, it refers to a tertiary comprehensive hospital playing a leading role in driving grassroots hospitals to input and output management concepts, technical levels, health talents, discipline construction, facilities and equipment, information platforms, logistics support and other resources. Y. Z. Li (2025) proposed that medical consortia are organizations formed by the vertical and horizontal cooperation of medical institutions of different levels and types in a region. The core is to optimize the allocation of medical resources and promote the process of disease prevention and treatment. Medical consortia are divided into four types of organizational forms: urban medical groups led by tertiary public hospitals in cities and jointly operated by community health service institutions; A county-level medical alliance community led by county-level hospitals, integrating township/village medical institutions and enhancing grassroots medical and health service capabilities; Specialized alliances formed through collaboration between specialized medical institutions in different regions; A remote medical collaboration network based on

information technology to break geographical limitations and enable grassroots, remote, and underdeveloped areas to enjoy high-quality medical resources.

In national level policy documents, the Guiding Opinions of the National Health and Family Planning Commission on Carrying out Pilot Projects for the Construction of Medical Consortia (Guoweiyifa [2016] No. 75) and the Guiding Opinions of the General Office of the State Council on Promoting the Construction and Development of Medical Consortia (Guobanfa [2017] No. 32) provide clear definitions of the concept of "medical consortia": "Medical consortia are medical service collaboration networks formed by vertically or horizontally integrating resources of different levels and types of medical institutions. In terms of local practice, health departments in Beijing, Shanghai, Fujian, and Sichuan have also provided specific explanations for the meaning of "medical consortia" in their respective implementation plans. According to the Implementation Opinions of the General Office of the People's Government of Sichuan Province on Promoting the Construction and Development of Medical Consortia (Chuanbanfa [2017] No. 75), "Medical Consortia" refers to a collaborative medical service network formed by different levels and categories of medical institutions in terms of resource sharing, functional positioning, etc., with relatively independent ownership of assets, administrative affiliation, and financial investment channels.

2.2 Implementation model of medical consortium

The medical consortium model, as an implementation method for integrating medical services, is becoming a choice for many countries to integrate medical resources, reduce medical costs, and improve medical quality. Due to differences in national conditions and the uniqueness of reform directions, countries have adopted different integration models, and typical models that have achieved significant results include the Kaiser Permanente model in the United States, the National Healthcare Service model in the United Kingdom, the Singapore Healthcare Group model, the German public contract service model, and the Japanese division of labor cooperation service model. Based on the definition of the concept of medical consortia in the previous text, this study has sorted out representative implementation models in the United States, the United Kingdom, and Singapore, in order to provide reference for the development of medical consortia in China.

2.2.1 The Chinese model

China is a multi-ethnic country with significant regional differences, with high terrain in the

west and low terrain in the east, forming three major tiers and uneven socio-economic development. Chinese Mainland can be divided into three regions according to the economic zone, namely, the east, the middle and the west. The difference between the east and the west is the most significant manifestation of China's economic regional difference. The east is relatively developed, while the west is relatively underdeveloped. Due to the regional differences in our country, the integration of medical and health service systems is influenced by various factors such as local politics, economy, and society, and the implementation paths of medical consortia vary in different regions. By searching for relevant literature on "medical consortia" and combining the definition of the concept of medical consortia in the previous text, this article summarizes the following representative implementation models of medical consortia in different regions.

(1) Heilongjiang Medical Association

Heilongjiang Province is located in the northeast of China, with Harbin as its capital city. Heihe City, located in the northwest of Heilongjiang Province, is situated on the northeastern border of China and is one of the fourth batch of pilot cities for the reform of national public hospitals. There are no tertiary Grade A medical institutions within its administrative jurisdiction, and it lacks high-quality medical and health resources and services. In August 2017, Harbin Medical University Affiliated First Hospital (hereinafter referred to as Harbin Medical University First Hospital) located in Harbin and Heihe First People's Hospital located in Heihe City, with the active support of the Heihe Municipal Party Committee and Government, carried out cross city medical alliance construction and assistance cooperation through medical cooperation. Harbin Medical University First Hospital is a large-scale comprehensive tertiary Grade A hospital integrating medical treatment, teaching, and scientific research, and is the largest medical center in Heilongjiang Province. The First People's Hospital of Heihe City is the only comprehensive tertiary Grade B hospital within the jurisdiction of Heihe City. The two academies have formed a model of "three assistance", "three sharing" and "three linkage" around the goals of "central cities driving remote areas" and "large medical institutions driving small and medium-sized medical institutions", as shown in Figure 2.1. At the same time, in 2018, Heihe City also launched the construction of an urban medical consortium led by the First People's Hospital, which will form a three-level vertical medical consortium model of "province city county (district)", allowing Heihe and adjacent Russian residents to enjoy expert services from provincial hospitals. Harbin Medical University First Hospital and Heihe First People's Hospital have formed a medical consortium to optimize the allocation of medical and health resources. Through technical support, resource sharing, equipment sharing, and other

forms, the overall service level of Heihe First People's Hospital has been improved, thereby further enhancing the accessibility of high-quality medical services within its radiation range and the trust of patients in Heihe First People's Hospital.

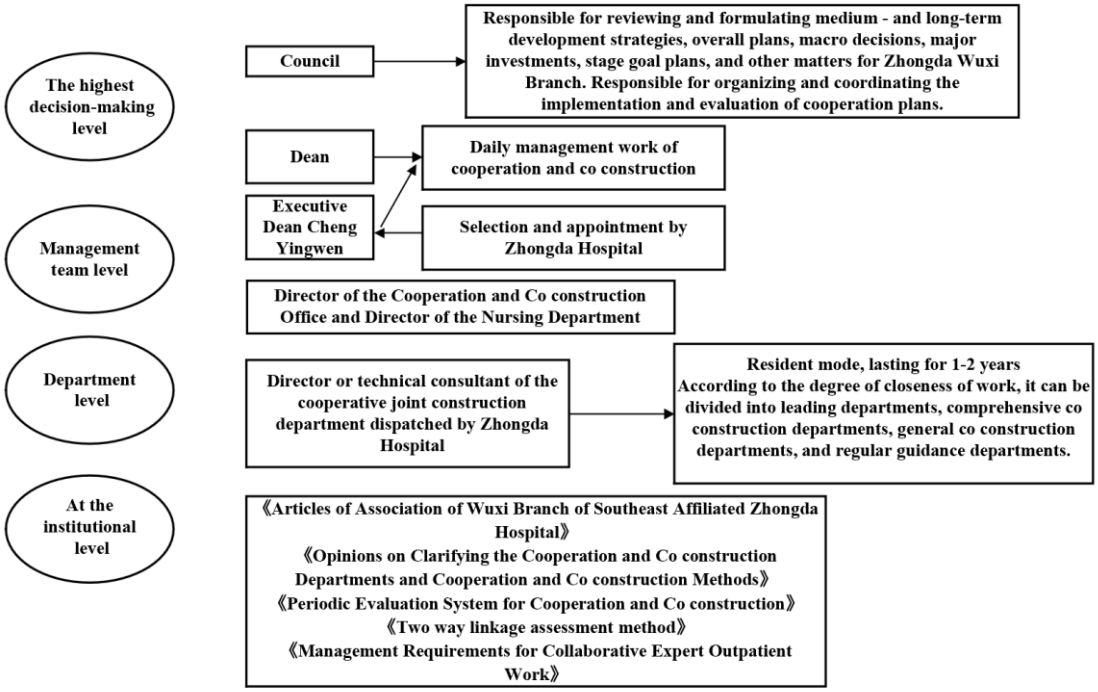


Figure 2.1 Management model of Xishan Medical Consortium of Zhongda Hospital

(2) Jiangsu Medical Association

Jiangsu Province is located on the eastern coast of China, with its capital city being Nanjing. Southeast University Affiliated Zhongda Hospital in Nanjing, as a comprehensive tertiary Grade A hospital and the only university affiliated hospital directly under the "985" and "211" projects of the Ministry of Education in Jiangsu Province, established a (cross city) semi close medical consortium with Xishan People's Hospital in Wuxi in June 2014 with the support of the Xishan District Committee and Government. Wuxi Xishan People's Hospital, relying on high-level university affiliated hospitals as the overall development foundation, operates through cooperation and co construction of branches, and is listed as the "Wuxi Branch of Southeast University Affiliated Zhongda Hospital". Under the governance structure of hospital collectivization, its operation mode is mainly the entrusted management (trusteeship) mode:

In terms of governance mode, Zhongda Wuxi Branch has established a council and implemented a dean responsibility system under the leadership of the council. Maintain the "four unchanged", namely independent legal personality, retaining the original affiliation, asset relationship, and financial allocation method unchanged. Zhongda Hospital selects and establishes a management team to be responsible for daily management work, and dispatches

department directors to guide department construction. In terms of management mode, it is necessary to carry out characteristic specialty construction, talent cultivation (such as further education, training, and overseas study), as well as teaching and research (such as conducting academic lectures, organizing continuing medical education projects, promoting scientific research output, etc.). The medical consortium will further promote cooperation, following the "1+N" model, with Zhongda Wuxi Branch as the core, gradually integrating the district's secondary public hospitals and community service centers in stages, thereby promoting the downward extension of high-quality resources. The Zhongda Xishan Medical Association implements a "joint fixed-point, total lump sum" model for residents' medical insurance, guiding primary diagnosis and step-by-step referral at the grassroots level. Strengthen regional informatization construction by establishing regional imaging diagnosis centers, electrocardiogram consultation centers, etc.

There are also literature cases from provinces and cities such as Hubei Province and Shanghai, which will be presented after further research and analysis.

In the construction of the Sichuan Medical Consortium, the core leading model with West China Hospital of Sichuan University as a typical example has typical demonstration significance. As the only national tertiary comprehensive hospital in the western region, it integrates a national level difficult and critical illness diagnosis and treatment center, a medical research innovation platform, and a technology innovation base, and occupies a core position in the regional medical collaboration system. The medical consortium led by it deepens strategic cooperation with local governments, relies on technology transfer and management output strategies, and focuses on promoting the transformation of prefecture level leading hospitals into regional medical service centers; On this basis, gradually improve the layout of the hierarchical diagnosis and treatment network, promote the sinking of high-quality resources to grassroots units from point to area, achieve the goal of resource sharing and collaborative development, and ultimately achieve the goal of equal development of medical and health services in the region and orderly flow of patients. This model is coordinated by local governments, with West China Hospital providing technical support and operational management, while collaborating with core medical institutions in the region to provide practical support. On this basis, integrate medical and health resources at all levels within the region, and form a 1+1+X medical consortium operation system with county-level hospitals as the leader, township health centers as the main body, and village level health clinics as the basis. The first "1" is the leading unit, the second "1" is the technical guidance center, and "X" is a member unit in the collaborative network. The design aims to create a comprehensive and

efficient collaborative hierarchical diagnosis and treatment service system, promoting the effective implementation of national hierarchical diagnosis and treatment policies. Since 2015, West China Hospital has taken the lead in establishing a close knit medical consortium of grassroots hospitals such as Guang'an People's Hospital, Ziyang First People's Hospital, and Mianzhu People's Hospital. In practical operation, member institutions generally adopt a delegated management approach, mainly implementing the following measures:

① Deepen government cooperation and jointly build strategic alliances

Huaxi Hospital and the government where the alliance hospital is located have jointly signed a strategic cooperation agreement to deepen government cooperation in medical services, implement separation of government affairs and management, and achieve "three unifications and sharing" on the basis of "three unchanged". The governance model is shown in Figure 2.2. Establish a "Medical Consortium Management Office" to be responsible for business organization and coordination, resource coordination and management, performance evaluation and management within the Medical Consortium.

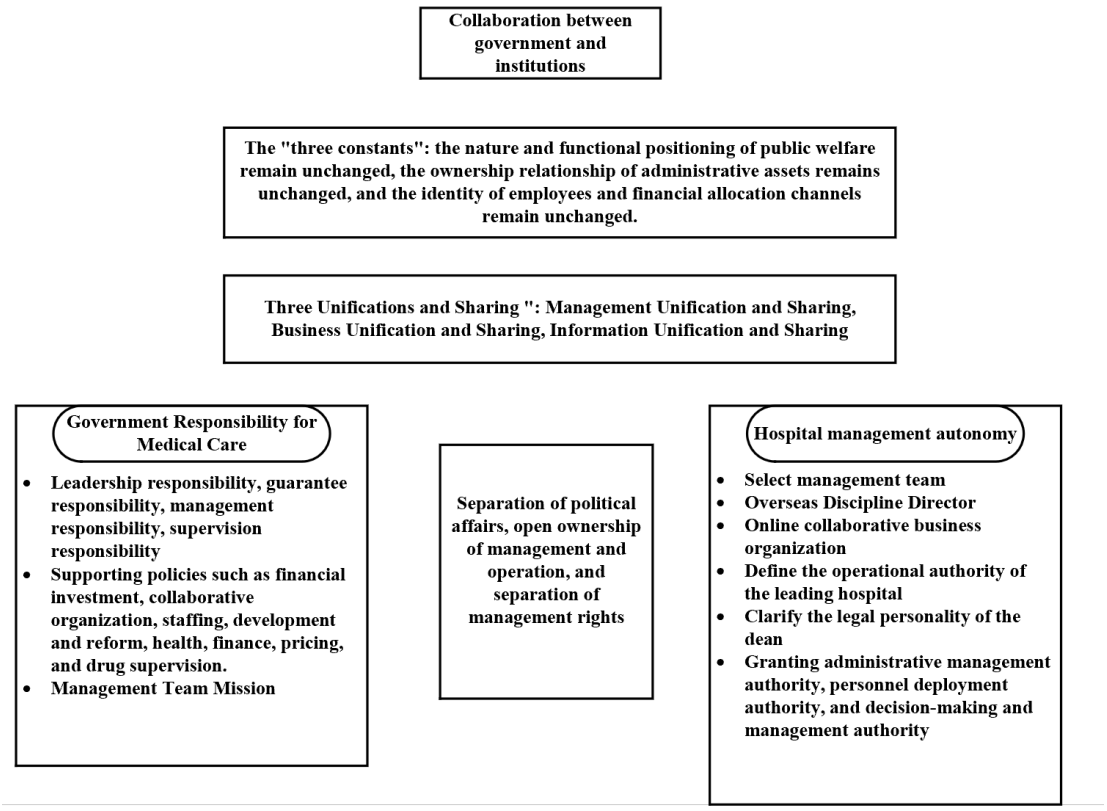


Figure 2.2 Governance structure of West China Hospital Leading Medical Consortium

② Share the Huaxi brand and achieve integrated management

On the basis of retaining its original name, the Alliance Hospital has adopted the second name of "Sichuan University West China Hospital XX Hospital". Implement a dual

management system for alliance hospitals, where both the local government and West China Hospital are responsible for supervising and assessing the hospital's operation and the work of the West China Hospital management team. The assessment results are linked to the total amount of hospital performance wages and special financial subsidies.

③ Expatriate management team to output management experience

West China Hospital has selected outstanding management talents to serve as the president and assistant president of the alliance hospital, inputting advanced management experience from West China, including strengthening medical quality control, standardizing hospital rules and regulations, improving operational management system, and promoting performance system reform, as shown in Figure 2.3. According to the management assessment method of West China Hospital, the management team is assigned management goals and tasks every year, and an annual assessment is conducted.

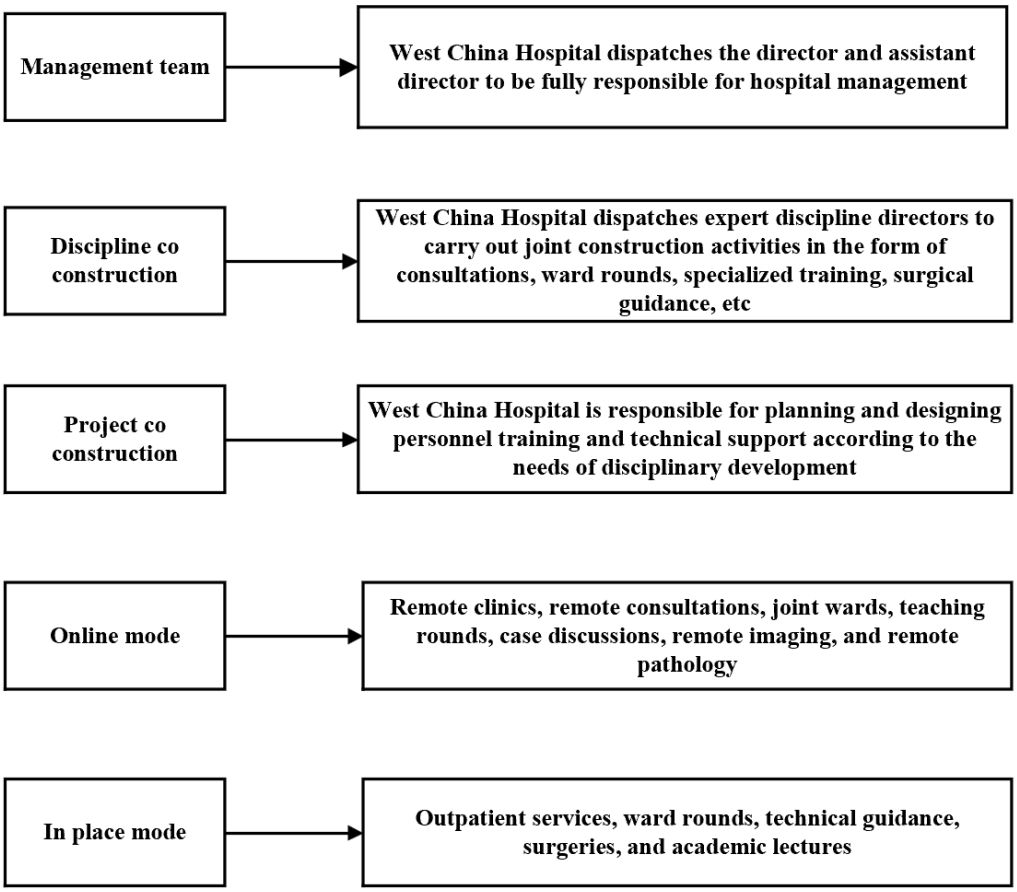


Figure 2.3 West China Hospital Leading Medical Consortium management model

④ Dispatched expert team to provide technical experience

Huaxi Hospital selects 3-5 disciplines as key co built specialties based on the actual needs of the alliance hospitals, and assigns deputy senior and above discipline directors from

corresponding departments to provide coordination and assistance, including assisting departments in formulating development plans, guiding discipline construction, conducting demonstration and examination rooms, expert clinics, surgical guidance, academic lectures, etc. Develop the 'Management Measures for Dispatched Discipline Directors' for assessment, and include them in the reserve management talent pool and recognize them in the promotion criteria for professional titles.

⑤ Combining "online" and "in place" to comprehensively promote assistance

In addition to "in place" assistance, West China Hospital is fully committed to promoting "online" assistance guidance, carrying out remote service projects such as remote consultation, remote teaching, joint outpatient services, mobile ward rounds, remote imaging diagnosis, and remote pathological diagnosis, extending West China Hospital's outpatient and ward services to medical consortium alliance hospitals in an online form.

⑥ Open a green referral channel and promote two-way referral

West China Hospital has opened a green channel for the referral of difficult and severe cases to alliance hospitals within the medical alliance. Difficult and severe patients can be transferred to West China Hospital through various channels such as on-site outpatient visits by West China experts, joint outpatient visits, and remote consultations. After treatment at West China Hospital, they can also be quickly transferred back to member units for rehabilitation treatment.

2.2.2 Other modes

(1) Kaiser Permanente

Kaiser Permanente (KP) was founded in 1945 as a non-profit comprehensive healthcare service organization and is one of the most successful Health Maintenance Organizations (HMOs) in the United States. KP covers 8 states in the United States (including California, Colorado, Georgia, etc.) and the District of Columbia, with headquarters located in Oakland, California. KP operates 39 hospitals and 675 medical clinics and other facilities. KP mainly consists of three independent and interdependent parts: Kaiser Foundation Hospitals, Kaiser Foundation Health Plans, and Kaiser Permanent Medical Groups, which integrate hospital groups, insurance companies, and doctor groups into one. Due to KP charging fixed prepaid premiums for the vast majority of its members, its strategy is to provide high-value medical services to maintain patient engagement and health.

KP has its unique collaborative medical model, which integrates three aspects: ① the

integration of financing payment system and service provision system, that is, the integration of insurance companies and medical institutions, and the surplus funds after providing services can be redistributed within the group, solving the problem of medical institutions lacking the motivation to save funds under the project payment model; ② The integration of the interests of suppliers and demanders, through comprehensive health management of service recipients by doctors, not only helps to reduce the economic burden of patients' medical treatment, but also saves medical costs that can be used for the distribution of doctors' income; ③ The integration of vertical and horizontal service provision, the Caesar model adopts a peer review method to assess and evaluate the cooperation, contribution, and service quality of medical staff, promoting collaborative treatment and cooperation between general practitioners and specialists, medical staff at different levels, and specialists for the same disease. At the same time, it achieves horizontal integration between preventive healthcare, outpatient, inpatient, and home rehabilitation, enabling seamless connection of services received by patients at different stages of the disease.

The continuous and integrated medical services provided by KP rely on a powerful shared information support system. KP established the largest electronic medical record system in the United States, KP Health Connect, in 2004, and established the electronic personal health record (PHR) - "My Health Manager" in 2007, which is connected to EHR. This information system enables the common sharing of member diagnosis and treatment information among various medical facilities, specialties, and positions of doctors in different levels of medical institutions within the group, effectively reducing unnecessary outpatient visits and repetitive examinations for patients, improving overall management efficiency and medical quality, and further reducing operating costs.

(2) National Health Service

The National Health Service (NHS) in the UK was established in 1948 and consists of three levels: primary healthcare institutions, regional hospitals, and teaching hospitals. It was once considered by the World Health Organization (WHO) to be the best healthcare service system in the world. The NHS is an important part of the UK's social welfare system, which is beneficial for the fairness and accessibility of healthcare services. However, it also faces issues such as low efficiency, high costs, and serious waste of resources. Therefore, since the 1980s, the British government has introduced internal market mechanisms in continuous reforms. In 1991, many hospitals spontaneously organized alliances under the advocacy and support of the British government, forming a certain scale Hospital Trust, or Medical Consortium, to improve

hospital operating efficiency and promote competition among medical institutions.

A hospital trust is an organizational consortium of several hospitals, with a specific council governance structure and legal personality. It belongs to the national health service system and has the power to operate and manage independently. It can take concerted actions to negotiate with the purchasing party on the provision of medical and health services, including the mode, quantity, and price. Its organizational form mainly includes two types: ① the type of comprehensive and multi-level coverage of regional health services represented by the Eastern Hospital Trust, led by the Royal Princess Hospital, consisting of 17 different levels and categories of health service institutions, basically covering primary and secondary health services in the region, as well as some tertiary health services in adjacent and local areas; ② A hospital trust represented by the alliance of two large teaching hospitals, Geiss and Thomas, covering a certain region and service level, mainly responsible for regional tertiary health services and emergency services. The hospital trust adopts a group operation mode and establishes a board of directors: one chairman of the board is appointed directly by the UK Cabinet Secretary for Health; The number of non-executive directors is equal to that of executive directors, with up to 2 non-executive directors from local communities appointed by the regional health bureau, and the remaining non-executive directors appointed by the Minister of Health and the chairman of the board after consultation. The operation and management issues of hospitals are usually resolved through joint consultation between representatives of physician organizations and managers. There is no administrative affiliation between hospital trusts and the government, but they must accept government supervision and management in personnel, financial management, and other aspects, including investment, loans, residual fund collection, and control.

(3) Singapore Group Medical Consortium

Since the 1980s, the Singapore government has carried out significant reforms to its public hospital management system guided by “competition, decentralization, responsiveness, and efficiency”, reorganizing healthcare resources and achieving the restructuring of the Regional Health System (RHS). The restructured hospital is divided into two competing medical groups based on the eastern and western regions, namely Eastern Cluster - Singapore Health Services (SHS), and Western Cluster - National Healthcare Group (NHG), responsible for integrating medical services in the eastern and western parts of Singapore. Resource sharing among various medical institutions within the group (including affiliated comprehensive hospitals, specialized centers, and clinics) forms regional cooperation, promoting the establishment of a more

comprehensive medical service mechanism within the group. Afterwards, it gradually developed into six regional healthcare groups, including Alexandra Health in the north, Estern Helath Alliance in the east, National Health Group (NHG) in the center, Jurong Health in the west, as well as National University Health System (NUHS) and SingHealth in Singapore. Each group relies on a regional hospital and collaborates with various primary, specialized, and long-term medical service institutions to form a regional medical consortium, providing patient-centered medical services. The Ministry of Health of Singapore will further restructure and pair the institutions of these six regional healthcare groups, dividing them into three major healthcare groups based on the eastern, central, and western regions: SingHealth in the east, NUHS in the central, and NHG in the west. Through the vertical and horizontal resource integration of the medical group, medical institutions of the same level and different levels have been included within the group, forming a resource sharing and two-way referral mechanism within the group. The Singapore Ministry of Health established the non-profit Health Corporation of Singapore (HCS) in 1985, which is responsible for overseeing all public healthcare institutions. Therefore, the Singapore healthcare group is controlled by the Ministry of Health, and its management rights are effectively separated from the government. The hospitals under the group are all separate companies with operational autonomy. The Ministry of Health has the power to supervise, manage, and make major decisions on medical groups, including the appointment and appointment of company directors and CEOs, revision of company articles of association, changes in company assets, termination and dissolution, and control over the total number of hospital beds, charging standards, and the purchase of expensive equipment. The operation mechanism of medical groups mostly adopts the dean responsibility system under the leadership of the board of directors. The board of directors is composed of representatives from various member units, responsible for formulating the hospital's development strategy, approving important personnel and finance, and supervising the quality of health services.

2.3 Dynamic capability theory

2.3.1 Concept and theoretical development

(1) Overview of enterprise dynamic capability theory

The theory of dynamic capability first emerged in the 1990s, and its emergence and development are closely related to the profound changes in the global market environment.

Against the backdrop of accelerated global economic integration and shortened technological innovation cycles, traditional competitive advantages are difficult to form a lasting trend. Enterprises can only rely on innovation capabilities to build core competitiveness and achieve sustainable development (Mei & Wu, 2016). As one of the representative figures in this field, D'aveni (1994) systematically elaborated on the main content of dynamic capability theory and provided a corresponding application framework.

The dynamic capability theory refers to the elastic ability of an organization to quickly launch products, effectively grasp ever-changing business opportunities, and continuously establish, adjust, and restructure its internal and external resources and intelligence to achieve competitive advantage (Teece & Pisano, 1994). It explains how businesses create business value. Dynamic capability "refers to the ability of enterprises to utilize IT technology resources, organizational resources, and management resources to gain competitive advantage (Eisenhardt & Martin, 2017). Similarly, companies can also meet the growing demands of customers and the market by cultivating unique and flexible capabilities. For information work, IT assets themselves cannot provide excess returns, but people have found that when they are reasonably applied in appropriate business processes, they will steadily promote the development of enterprises and bring excess returns to them. In the field of strategic management, the pursuit of competitive advantage for enterprises and how to obtain and maintain competitive advantage have always been the focus of attention for management scholars and business professionals. In dynamic environments, research on the dynamic capabilities of enterprises has increasingly become a hot topic in the theoretical community. This article analyzes the characteristics and influencing factors of dynamic capabilities, as well as the acquisition of dynamic capabilities by enterprises, and proposes the formation mechanism of enterprise dynamic capabilities.

(2) Definition of dynamic capability

The organizational capability of an enterprise is essentially the core ability used by the enterprise to build competitive advantages and to make reasonable use and deployment of various resources. However, the traditional resource-based view has significant limitations in static attributes, which makes it difficult for the resource-based view to fully meet the needs of real-world market scenarios in explaining how to continuously gain and maintain competitive advantages in complex and changing market environments. Based on the above theoretical pain points, Teece and Pisano (1994) first proposed the innovative concept of "dynamic capability" and supplemented and improved the shortcomings of the resource-based view theory. They define dynamic capability as a key subset that essentially belongs to the competitiveness or overall capability system of the enterprise. The core role of dynamic capability is to drive the

process of developing and creating new products or services for the enterprise. At the same time, dynamic capability can empower the enterprise to perceive market environment changes sensitively and make timely responses to adapt to market changes, thereby occupying a favorable market position in the dynamic competitive landscape.

Afterwards, Teece and other scholars further refined and deepened the concept of dynamic capability in their groundbreaking academic article published in 1997. In the process of deepening, Teece and other scholars have clearly pointed out that dynamic capability is the core ability of enterprises to effectively integrate, actively construct, and flexibly reconstruct internal and external resources in a market environment with significant uncertainty and rapid iteration, thereby achieving resource optimization and allocation, and ultimately achieving the goal of gaining competitive advantage. After the revision of the relevant concepts of dynamic capability, it is more in line with the dynamic scenarios faced by enterprises in actual operation processes, and also lays an important theoretical foundation for the subsequent research on dynamic capability in related fields.

Following closely behind, numerous scholars have conducted in-depth explorations around dynamic capabilities, and based on different theoretical perspectives and research paradigms, have further expanded and enriched the relevant conceptual connotations and theoretical frameworks of dynamic capability theory. From the perspective of evolutionary economics, Eisenhardt and Martin (2017) proposed a unique view on dynamic capability, which believes that the essence of dynamic capability is a series of processes in which an enterprise manages and utilizes its own resources, mainly reflected in key links such as the integration, reconstruction, acquisition, and timely release of its own resources. The core goal of these links is to enable the enterprise's resource allocation to respond to changes in the market environment, and even hope that in certain situations, the enterprise can actively create market changes and guide the direction of market development. At the same time, they believe that dynamic capability is an important guarantee for enterprises to form new resource allocation models and cope with market dynamic changes when facing various market states such as market birth, market changes, collisions and interactions between market entities, segmentation and fragmentation, evolution and upgrading, decline and extinction. In addition, Eisenhardt and Martin (2017) pointed out in their study that the dynamic capabilities of different enterprises do not fully exhibit differentiated characteristics. In many key aspects and core dimensions, the dynamic capabilities of many enterprises often exhibit certain common characteristics, which are important components of the dynamic capability theory system and provide important basis for understanding the common laws of dynamic capabilities among enterprises. From the

perspective of organizational learning theory, Zollo and Winter (2002) redefined the concept of dynamic capability. They believe that dynamic capability is a stable and collective activity pattern that gradually forms and is fixed through a long-term learning process within the enterprise. Moreover, this activity model can systematically promote the organization to continuously generate new operational practices, and make targeted modifications and optimizations to existing operational practices. This series of activities can ultimately continuously improve the operational efficiency of the enterprise, thereby enhancing its comprehensive competitiveness in the market, enabling the enterprise to maintain a competitive advantage and stable development in the market competition environment for a long time. From the perspective of expanding and extending dynamic capabilities from the traditional resource-based view, Winter (2003) proposed an innovative viewpoint that dynamic capabilities are the ability of enterprises to expand, extend, modify, improve, or directly create new ordinary capabilities in the process of their own development. This viewpoint emphasizes the close connection between dynamic capabilities and the existing ordinary capabilities of enterprises, highlighting the core driving role of dynamic capabilities in the upgrading and evolution process of enterprise capability systems, and providing new ideas for understanding the dynamic development mechanism of enterprise capabilities in the future. From the perspective of behavioral theory, Helfat et al. (2009) provided a new interpretation of the concept of dynamic capability. They explicitly stated that dynamic capability is the ability of an organization to create, expand, and modify its resource base in a planned and purposeful manner, guided by clear goals. In addition, Døving and Gooderham (2008) defined dynamic capability as the ability to integrate, construct, and restructure internal and external resources to change operational capabilities and adapt to dynamic and complex changing environments. Therefore, dynamic capability reflects the organizational ability to gain new competitive advantages under specific path dependencies and market positions. Eisenhardt and Martin (2017) explain dynamic capability as the use of resources in company processes, particularly in integrating, restructuring, acquiring, and releasing resources, to cater to or even guide changes in the market environment. Therefore, dynamic capability is the organizational and strategic process by which a company obtains new resource allocation. Zollo and Singh (2004) believed that dynamic capability is a sustainable pattern that enables enterprises to maintain stable collective learning behavior. Through this pattern, organizations can generate and adjust their operational processes, thereby improving efficiency. Another scholar defines dynamic capability as the ability of the main decision-makers of a company to reconfigure its resources and manage them in the way they believe is correct. Dynamic capability emphasizes the importance of founders

and executive team members in the construction of dynamic capabilities. This conceptual definition of dynamic capabilities highlights the organizational and proactive nature of organizations in the application of dynamic capabilities, emphasizing that the application of dynamic capabilities is a conscious behavioral activity undertaken by organizations to achieve specific strategic goals.

(3) The emergence of dynamic capability theory

In the early 1980s, Porter's theory of industrial organization became the mainstream idea in the field of strategic management. With the growing development of core competency theory and its inherent flaws gradually exposed, in the highly dynamic market environment, the static core competencies mastered by enterprises may become shackles that hinder their own development. This situation has put the traditional concept of capability in a bottleneck period, unable to explain well how companies gain competitive advantages in the rapidly changing process, and also unable to reveal the reasons why some companies can maintain their advantages indefinitely. In this context, Teece et al. (1997) first proposed the concept of "dynamic capability", defining it as an important characteristic of enterprises integrating, developing, and recombining internal and external resources to cope with external environmental changes. At present, the theory of dynamic capability is in a critical period of development and deepening. This study categorizes dynamic capability as the driving force for maintaining or updating the main competitiveness of enterprises, and systematically discusses its characteristics as a process that relies on integrating internal and external resources, adopting learning approaches, and improving knowledge management strategies to promote innovation. This process aims to open up unknown areas and build new capabilities and construction paradigms to effectively allocate and rearrange existing assets, thereby comprehensively improving performance indicators and maintaining sustained advantages in an environment full of uncertain factors.

Understanding and explaining the sources of a company's competitive advantage has always been one of the central issues in research on corporate strategic management. From a historical perspective, the explanation of the sources of competitive advantage for enterprises has gone through a back and forth process from the inside out to the outside in, with the industrial organization theory school and resource-based view (RBV) theory being the main representatives (Yang, 2017). The competitive advantage theory of the industrial organization school based on the "S-C-P" paradigm holds that the purpose of strategic design is to enhance a company's bargaining power over upstream suppliers and downstream customers through appropriate industry positioning, while also building entry barriers to prevent existing and

potential competitors from eroding its advantageous position (L. S. Wang, 2007). The resource theory holds that the source of a company's competitive advantage lies in its specific resources and capabilities, and the company obtains competitive advantage by adopting corresponding value creation strategies (Shao & Meng, 2015). The difference between these two basic paradigms mainly lies in the fact that the industrial organization theory school assumes market positioning as the basic premise, while the resource theory believes that the unique resources within the enterprise are the fundamental source of its competitive advantage. In the 1990s, within the basic theoretical framework of the resource view, the core competence theory school gradually emerged. Prahalad and Hamel (1994) believe that core competencies of enterprises have applicability, value, and difficulty to imitate, and can become a source of competitive advantage for enterprises.

Although the resource theory has been widely applied in the field of strategic management research in recent years, it still faces fierce questioning from many scholars. And the greater challenge facing this theory comes from the changing competitive environment outside the enterprise. In this dynamic environment, the basic mode for enterprises to gain sustained competitive advantage has changed from pursuing a lasting competitive advantage to continuously obtaining a series of temporary competitive advantages. The advantages formed by enterprises based on industry positioning or their own resource strength in a highly competitive business environment are easily overturned by rapidly iterating new technologies. In this environment, enterprises must adapt to changes in the external environment as soon as possible and dynamically adjust the allocation of internal resources. The dynamic capability theory based on resource-based view has gradually formed and developed on the basis of integrating and developing traditional management ideas. This article aims to understand the development process, connotation, and practicality of dynamic capability theory through research.

2.3.2 Characteristics and influencing factors

(1) Characteristics of dynamic capability

Dynamic capabilities are pioneering (Ruiz-Ortega et al., 2024). The dynamic capability theory originates from the resource-based theory and incorporates many perspectives from the core capability theory, thus sharing similarities in characteristics with core capabilities. But dynamic capability is the ability to change a company's capabilities and has pioneering power in innovation. The driving force of innovation may be regenerative or pioneering, as regenerative forces that tend to be based on empirical experiences with strong path dependence

cannot change the inertia in capabilities. The dynamic capabilities of enterprises not only focus on the unique organizational practices of the enterprise, but also on the innovative and pioneering abilities to overcome the inertia of capabilities. In a dynamic environment, dynamic ability advocates the establishment of exploratory learning ability. Exploratory learning ability is a learning focused on change aimed at providing new strategic concepts to enterprises in the long term. Therefore, in order for a company to gain sustained competitive advantage, what is needed is the ability to engage in creative destruction.

Dynamic capabilities have openness (Al Nuaimi et al., 2024). The dynamic capability built on pioneering power exhibits an open characteristic. Dynamic capability is the product of an enterprise integrating internal knowledge and absorbing knowledge. Because the absorption of knowledge serves as a bridge between internal and external resources and capabilities within the enterprise, the dynamic capability theory emphasizes the establishment of special abilities to absorb knowledge from external sources. This is significantly different from the resource-based theory and core competency theory that emphasize the internalization and accumulation of enterprise capabilities. Dynamic capability exhibits flexibility due to its openness, thereby reducing the lack of rigidity in the capability.

Dynamic capabilities are complex and difficult to replicate (Teece et al., 1997). The dynamic capabilities in a dynamic environment are complex because they are built on the foundation of the enterprise's processes, which are inherently complex. At the same time, the close interconnectedness of enterprise processes leads to consistency in organizational capability systems at different levels. If certain parts of the enterprise's processes are changed, it will inevitably cause corresponding changes in other parts of the processes. In this case, replicating dynamic capabilities becomes very difficult.

Factors influencing the formation of dynamic capabilities

The dynamic capability of an enterprise exists in its organizational and management processes, and its formation is determined by the asset status and development path of the enterprise. Teece et al. (1997) argue that internal and external capabilities of an enterprise include organizational skills, resources, and capabilities. Dynamic capabilities are placed within its management and organizational processes, and a process, location, and path analysis framework for dynamic capabilities is constructed. The dynamic capability theory is a developing theoretical frontier, with the current focus on the analytical framework mentioned above.

The formation of dynamic capabilities is mainly determined by two factors: organizational design and human resource management. This is because, on the one hand, through

organizational design, companies can establish organizations led by middle-level managers, which can promote the dynamic ability of business diversification (Furr, 2019); On the other hand, strengthening human resource management can promote the formation of dynamic capabilities, and emphasize that human resource management should start from several aspects: selecting candidates should pay attention to the breadth and depth of knowledge; The concept of job description should be detailed and specific; Expand the breadth and depth of employees' existing knowledge through training; And inspire success, tolerate failure (Lubatkin et al., 2006).

The dynamic process of knowledge formation is also the evolution process of dynamic capabilities (Karimi & Walter, 2015). In order to answer the question of how successful enterprises develop superior resources and knowledge, and how they construct dynamic capabilities to maintain this superiority in the long term, products are regarded as a variable in the framework of capability view. The development of products is supported by the enterprise's knowledge system and learning system, and enhances the enterprise's knowledge and learning capabilities. From the perspective of the role of enterprise knowledge in dynamic capabilities, the process of changing the ability of an enterprise is the process of pursuing new knowledge (Jiao et al., 2021).

(2) An analytical framework for enterprises to acquire dynamic capabilities

The acquisition of dynamic capabilities means that enterprises have new knowledge about resource utilization and new ways of combining resources. In other words, enterprises can stimulate services within their existing resources, obtain resource services owned by external enterprises, and obtain new ways of coordinating, integrating, and configuring resources (Park & Kim, 2013). Below we propose an analytical framework for enterprises to acquire dynamic capabilities. Enterprises begin to form or possess a series of resources and capabilities during their growth, and these resources and capabilities (such as organizational capital and technological capabilities) are formed in the development of specific market opportunities. In the context of market changes, their value is limited, therefore, enterprises need to update these resources and capabilities to form new dynamic capabilities, only in this way can new market opportunities be developed and utilized to promote enterprise growth. We believe that acquiring dynamic capabilities can be approached from both internal and external perspectives of the enterprise. Internally, resource restructuring and learning can be implemented; Externally, new resources and capabilities can be obtained through enterprise network learning and resource integration.

2.3.3 The core logical analysis of dynamic capability theory

1. The key connotation of dynamic capability theory is to systematically evaluate the development trends and potential opportunities of internal and external environments, and based on this, formulate and implement corresponding strategic plans. At this point, enterprises should choose short-term, non continuous partners to complete a strategic task and rely on collaborative competition mechanisms to form core competitiveness. After achieving the established strategic goals, it is necessary to promptly end the existing cooperative relationship and return to the initial stage to explore new paths of innovation. By relying on this constantly updated innovation cycle model, enterprises can cope with the complex and ever-changing competitive environment and maintain the driving force for sustainable development over a long period of time.

2. The strategic goal of enterprises based on dynamic capability theory is to create and maintain a lasting competitive advantage. The reason for the emergence of this idea is the complex and highly uncertain market environment, where traditional competitive advantages are difficult to maintain in the long run. If a company sticks to its existing competitive landscape and does not innovate, it will fall into more serious strategic difficulties. Only through continuous reflection and upgrading optimization, quickly discovering new opportunities while constantly breaking through the current industry balance, and efficiently combining various internal and external resource elements to shape multiple independent core competencies, can sustainable long-term development goals be achieved. This strategic essence guided by dynamic capabilities belongs to the innovation driven development model.

3. From the perspective of dynamic capability theory, analyze in detail the strategic intentions of competitors and explore what important components they are for the strategic formulation of enterprises. In the increasingly fierce market competition, the frequency of games between competitors has greatly increased, and competitive interaction has become an important force that influences the development path of enterprises. Only by grasping the changing trend of the opponent’s strategy can we seize the best opportunity window, break the already formed competitive advantage, and create new competitive barriers.

4. Creating dynamic capabilities and shaping core competitiveness for enterprises has become an important part of implementing differentiation strategies. This process should follow the principles of flexibility and adaptability, continuously improving the organizational structure and resource allocation system, reorganizing internal and external resource elements, shaping a unique enterprise ecosystem, and then relying on strategic operations to explore

market areas with both growth and development potential.

5. From the perspective of dynamic capability theory, in order for enterprises to achieve strategic goals, they must rely on cross organizational cooperation. This type of cooperation has a phased characteristic, relying on a certain period of time or task cycle to form a short-term, discontinuous partner network. After the established mission is completed, the original cooperative relationship will terminate, prompting the enterprise to conduct a new round of partner selection, resource integration, and strategic adjustment when new opportunities arise, and based on this, formulate and promote subsequent strategic implementation plans.

From the above analysis, it can be seen that the main drawbacks of this theory are:

(1) This theory assumes that the market environment is highly dynamic and uncertain. Financial markets have a certain degree of predictability and stability over a certain period of time.

(2) This theoretical framework denies the essence of a company's ability to establish sustainable competitive advantages and questions its unique value in terms of accumulation, path dependence, and difficulty in imitation.

(3) This theory holds that cooperation between organizations is task oriented, and cooperative relationships are limited and temporary.

2.3.4 The research context of dynamic capability

In the early stages of organizational capability research, most scholars explored organizational capability mainly from the perspective of internal processes within the enterprise. Under this research framework, dynamic capability is divided into multiple specific dimensions such as coordination capability, integration capability, learning capability, and restructuring capability. The core focus of the research is how enterprises optimize and transform their internal organizational capabilities by integrating and reallocating their own internal resources and externally available resources to adapt to changes in the market environment (Hong & Snell, 2013). With the continuous deepening of research, firstly, from the perspective of entrepreneurship and innovation scenarios, related activities are more likely to occur in large network systems composed of multiple independent or semi independent enterprises, rather than existing in isolation. Based on this reality, many studies have begun to analyze dynamic capabilities from the network level (Giudici et al., 2018). However, existing research mostly focuses on the impact of specific network characteristics on dynamic capabilities, such as the social capital possessed by entrepreneurs, the degree of embedding of enterprises in the network, the connection of social relationships between enterprises, and the structural east-west effect in

the network structure (Jiang et al., 2020; J. J. Wang et al., 2017). However, the network itself has a certain degree of locality, and there is no way to fully explain how enterprises attract external partners to participate in the process of creating dynamic capabilities. Secondly, in the research process of dynamic capabilities, there is a large amount of research that revolves around theoretical exploration of supply chain dynamic capabilities, with a focus on analyzing the impact of supply chain capabilities composed of different dimensions on enterprise performance. Beske (2012) applied dynamic capability theory to the field of supply chain research earlier and proposed that supply chain dynamic capability is an ideal form of ability for this complex system to respond to external environmental changes and internal complex relationships. It is explicitly stated that supply chain dynamic capability includes multiple core dimensions such as knowledge acquisition and evaluation, and joint development capability. Giorgi and Weber (2015) found that dynamic supply chain capabilities can significantly enhance organizational flexibility, enabling organizations to adapt more easily and quickly to market trends, and more effectively respond to challenges brought by market fluctuations, ultimately helping companies gain sustainable competitive advantages in the industry. Furthermore, in the context of the rapid development of the digital economy, dynamic capabilities are no longer limited to internal enterprises, but can be created through collaborative cooperation with other participants in the business ecosystem. Based on this background, research on dynamic capabilities has begun to shift towards the dynamic capabilities of core or leading enterprises in the platform ecosystem (Giudici et al., 2018). For example, Teece (2018) study found that dynamic capabilities can help companies create and acquire enterprise value through building ecosystems, designing reasonable business models, and other means. Among them, resource integration capabilities play a key role in enhancing platform leaders' ability to acquire enterprise value. Finally, in the context of digitalization, the application scenarios of dynamic capabilities have gradually extended from traditional manufacturing and service industries to the medical field, until 2005 when their application in the medical field gradually became an emerging research direction (Min, 2017). Hospitals are the theme of health maintenance, and fully enhancing dynamic capabilities is to ensure that hospitals can acquire and maintain service advantages to ensure sustainable development in the process of digital transformation, compliance with reform requirements, and national demand (T. Chen et al., 2017). For medical consortia, loose medical consortia can achieve integration of medical resources, collaboration among medical institutions, and improve efficiency by establishing competitive power mechanisms, external incentive elm mechanisms, internal quality and efficiency improvement mechanisms, and enhancing dynamic capabilities, thereby

improving efficiency and gaining competitive advantages (Sun et al., 2021). Xiao et al. (2025) found that empowering grassroots medical and health institutions with dynamic capabilities to carry out medical prevention integration work can help deepen the understanding of the role of dynamic capabilities. Specifically, enhancing the perception ability of medical and health institutions can help them cope with changes in external environments such as the health environment, policy environment, and industry environment; Enhancing the learning ability of medical institutions can promote the subdivision and reduction development of medicine; Enhancing the integration capability of medical institutions can help them cope with the multi-dimensional fragmented development of medical prevention resources and services.

Based on the above research results, it can be seen that with the expansion and transformation of the research perspective of dynamic capabilities from internal to external enterprises, the research object of dynamic capabilities is no longer limited to a single enterprise, and the study of dynamic capabilities outside the boundaries of enterprises has gradually become a research hotspot in the academic community (Ma et al., 2015). At present, the academic community has conducted research on different levels of dynamic capabilities such as supply chain level, platform ecosystem dynamic capabilities, and medical services. The study of dynamic capabilities in the field of medical services has become one of the current research focuses. The dynamic capability of medical services and the management capability of medical insurance are the core connotations of high-quality development of medical institutions (Tian et al., 2022). Therefore, in the current research context, how to build the dynamic capabilities of medical services in the medical field has become an important issue worthy of further exploration by the academic community.

2.3.5 Research on the dimensions and measurement of dynamic capability

More and more scholars are realizing that dynamic capability is not a single concept, but presents in different forms. One form of dimensionalizing dynamic capabilities is to view them as perceiving new opportunities (Teece, 2007). In this classification model, dynamic capabilities reflect a series of different organizational operation procedures, which are centered on three key levels: first, opportunity perception ability, which can comprehensively perceive the changing trends of the business environment, accurately identify emerging opportunities and potential threats; The second is the ability to utilize opportunities, that is, to make scientifically reasonable strategic choices based on the actual situation in the process of selecting numerous investment opportunities and business models; The third is the ability to restructure resources, which refers to the ability to reorganize and optimize the internal resource

allocation, structural system, and existing capabilities of the organization based on strategic adjustment needs. After considering the above viewpoint, H. Wu (2016) believes from the perspective of opportunity that opportunity perception involves external integration, essentially the ability to identify opportunities, and the ability to utilize and reconstruct opportunities is the process of internal integration within the enterprise, with a focus on the ability to utilize opportunities. Subsequent scholars have also conducted research on the dimensions of dynamic capabilities from a resource perspective, while focusing on the above viewpoints. For example, Dong and Ge (2012) divided dynamic capabilities into five dimensions based on the resource perspective: resource integration capability, resource reallocation capability, learning capability, adaptation capability, and innovation capability. So another type of classification research on dynamic capabilities in academia places more emphasis on entrepreneurial spirit and believes that in the management decision-making process driven by entrepreneurial spirit, there are fewer constraints from fixed management. For example, Adner and Helfat (2003) proposed the concept of dynamic management capability and explicitly stated that practical experience and patterned behavior are stable foundations in the decision-making process of management. And this stable foundation covers multiple levels, including management capital composed of human capital, social capital, and cognitive recognition ability, as well as the psychological activity process of managers in the decision-making process.

Currently, with the gradual emergence and widespread application of digital infrastructure such as artificial intelligence and digital transformation, enterprises are facing a significantly accelerated pace of change, and the instability, complexity, and uncertainty presented by the market environment are also increasing (Sousa-Zomer et al., 2020). In the context of this era, the research direction of the academic community is also adjusting accordingly. Scholars tend to focus more on studying dynamic capabilities in line with the current development of the times, thereby expanding the application scenarios and in-depth research of dynamic capability theory. Among them, Helfat and Raubitschek (2018) conducted research on digital platform enterprises, delving into the three dynamic capabilities that such enterprises must possess in the process of creating and capturing value: innovation capability, environmental scanning and perception capability, and integration capability for ecosystem orchestration. They believe that innovation ability can support the platform to continuously launch new products and services that meet market demand, environmental scanning and perception ability can help enterprises timely perceive market changes and potential opportunities for change, and the integration ability of ecosystem orchestration can help enterprises coordinate various resources and entities within the ecosystem to achieve collaborative development. These three abilities play a crucial

role for enterprises. Warner and Wäger (2019) further enrich the existing dynamic capabilities by proposing digital perception capability, digital utilization capability, and digital reconstruction capability. It believes that organizations in the digital age can leverage digital infrastructure to collect and analyze large-scale real-time refined data, while using artificial intelligence technology and data analysis methods to explore the previously imperceptible value of big data, providing support for enterprise decision-making. Digital utilization capabilities can help enterprises break through inherent organizational boundaries, actively use digital platforms, explore new business models, and transform perceived opportunities into actual benefits. Digital reconstruction capabilities can help enterprises carry out deeper reforms, including reshaping organizational culture, redesigning organizational structure, and effectively managing innovation ecosystems, providing more comprehensive guarantees for enterprises in the trend of digital transformation. Looking back at the above research, although scholars have conducted a lot of effective studies on the division of dynamic capability dimensions, a unified dimension division standard has not yet been formed. Therefore, in subsequent research, it is necessary to reasonably select the dimensions of dynamic capabilities for analysis based on the research background and objectives of the research itself, in order to ensure the pertinence and effectiveness of the research conclusions.

Based on the study of different partition dimensions in dynamic dimensions, scholars have also developed rich research on the measurement of dynamic capabilities. The measurement of dynamic capabilities of enterprises always revolves around the logic of resource integration, process change, and external collaboration. L. Y. Wu (2007) emphasized resource integration ability, resource reallocation ability, and learning ability in measuring dynamic capabilities. Drnevich and Kriauciunas (2011) focus on the development of new products or services, the implementation of new business processes, and the establishment of new customer relationships and changes in business practices. Sousa-Zomer et al. (2020) focused on measuring dynamic capabilities, including knowledge exploration ability, risk management ability, and marketing ability; Dong and Ge (2012) measured the dynamic capabilities of enterprises from several perspectives, including environmental adaptability, change and update capabilities, technological flexibility, and organizational flexibility. And measure dynamic capabilities from perception, transformation, and capital capabilities related to knowledge and innovation. This study refers to the research of Scuotto et al. (2024), divides the dynamic capabilities of medical services into three dimensions: cross functional team collaboration capabilities, medical resource strategic allocation capabilities, and external strategic alliance collaboration capabilities to measure the dynamic capabilities of medical services.

2.3.6 Research on the antecedents of dynamic capabilities

The core goal of studying the dynamic capabilities at the micro level is to reveal the micro basis of their formation, which refers to the basic psychological explanations starting from a lower level of analysis (Felin et al., 2015). This type of research aims to provide theoretical and empirical support for the analytical dimension beneath the phenomenon itself. The core value of the micro foundation theory of dynamic capabilities is largely reflected in its ability to explain how enterprises rely on technological, organizational, and environmental conditions, and respond to changes in the market environment in a unique way.

The digital innovation capability and digital infrastructure construction at the technical level are key prerequisites for managers to undergo cognitive changes and promote the formation of dynamic capabilities. Based on a case study, Luo et al. (2023) clearly pointed out that the implementation and application of digital facilities such as digital productivity will directly affect the transformation of industries, markets, and policy fields. This transformation will stimulate the cognitive process of managers and encourage them to construct activities through strategic significance, thereby promoting the restructuring and upgrading of organizational resources into dynamic capabilities. The construction of digital infrastructure provides a technological foundation for the evolution of dynamic capabilities, while digital innovation capabilities are involved in the process of resource reconstruction and capability upgrading. In the context of digital technology penetration, the knowledge and experience reserves of managers, especially the diversity of knowledge related to digital technology, have become important variables in cognitive ability, and their cognitive characteristics play an important role in technological innovation capability (Lubatkin et al., 2006). For small and medium-sized enterprises, the opportunity recognition ability can be enhanced through the digital technology knowledge reserve of managers or entrepreneurial teams, and this opportunity recognition ability is an important manifestation of digital innovation capability. Research has shown that the impact of entrepreneurial experience on managers' ability to develop new product markets is more specifically manifested in the digital age as the ability to integrate resources through digital facilities and open up new tracks with digital innovation capabilities. This experiential dimension has also become an important measure of dynamic capabilities (Ener, 2019). The supply of digital resources and organizational digital attention at the organizational level are the core support for the transformation of dynamic capabilities from potential to reality. Organizational digital attention is reflected in the perception and utilization orientation of the value of digital resources, while the supply of digital resources is the material

basis for capacity building. Pandza and Thorpe (2009) proposed that creative search and strategic meaning construction are key factors driving the evolution of dynamic capabilities. In the digital context, this creative search is essentially a concentrated expression of organizational digital attention, focusing on the opportunities and challenges brought by digital technology, while strategic meaning construction relies on the effective supply and implementation of digital resources. The case study by L. Zhang et al. (2019) shows that the process of managers' meaning construction triggered by external environmental changes is the logical starting point for the evolution of enterprise innovation capabilities, and will promote the organization's allocation and attention orientation of digital resources. By focusing digital attention on the true core of internal and external resources, individual cognition can evolve towards organizational logic, resource action, and ability advancement. Furthermore, from the perspective of resource-based view, the more resources an organization possesses, the more resources it can integrate and reconstruct dynamic capabilities. The richness of digital resource supply directly determines the upper limit of capability upgrading (Liu & Jiang, 2009). Park and Kim (2013) emphasized the mechanism of organizational redundancy, which is more specifically manifested as digital resource redundancy in the digital age. This redundancy of digital resources not only includes hard resources such as physical reserves and digital tools, but also includes soft resources such as digital technology talents. Its existence can effectively promote the formation of dynamic ability utilization capabilities. It cannot be denied that the allocation efficiency of digital resource supply directly affects the evolution path of dynamic capabilities. Currently, in the context of digitalization, peer competition pressure is an important catalytic factor that drives enterprises to achieve differentiated advantages through dynamic capability building, especially in special fields such as healthcare. Satisfying medical needs can provide a clear direction for the evolution of abilities. Shamsie et al. (2009) found through a case study that differentiated replication and updating strategies contribute to the development of dynamic capabilities. In the medical field, such differentiated strategies often stem from peer competition pressure, which means that when competitors optimize service processes through digital technology, companies need to accelerate the iteration of dynamic capabilities to maintain their competitiveness. In the medical field, enterprises need to respond to the upgrading of medical needs, such as precision diagnosis and treatment, remote medical care, etc., by dynamically adjusting product market strategies, and peer competition pressure will accelerate this process of adjustment. The theoretical model proposed by B. Y. Zheng et al. (2011) indicates that competitive strategy significantly affects dynamic capabilities. In the digital transformation of healthcare, the formulation of such competitive strategy urgently needs to benchmark the digital

technology application level of peers and also closely focus on the core pain points of medical needs. Parnell (2011) research found that differentiation orientation is positively correlated with high strategic capabilities in the technology field, which also means that in the dual role of peer competition and demand driven love, the differentiation strategy of medical enterprises needs to be supported by digital technology, and dynamic capabilities are the key link connecting strategy and demand satisfaction.

It is worth noting that research has shown that differentiated strategic management may lead to changes in knowledge management capabilities. In the medical field, the core of this change is knowledge iteration formed around meeting medical needs, and peer competition will force companies to transform this knowledge iteration into service advantages through dynamic capabilities. However, existing research mostly overlooks the legitimacy issues that high differentiation may bring, especially in the medical field. Overly radical digital innovation may face regulatory questioning. Therefore, in the dual constraints of peer competition and demand satisfaction, how platform enterprises balance differentiation and legitimacy through dynamic capabilities still needs further exploration.

2.3.7 The impact of dynamic capabilities on the competitive advantage of enterprises

The correlation between dynamic capabilities and competitive advantages of enterprises.

Teece et al. (1997) studied the properties of dynamic capabilities from the perspectives of replicability and imitability, and found that capabilities are difficult to replicate due to the inherent ambiguity of their internal structure, the interdependence between multiple capabilities, and the historical specificity of their formation. In addition to the aforementioned reasons that make it difficult to imitate abilities, there are other factors such as intellectual property protection, trade secrets, trademarks, and corporate style restrictions that can also hinder competitors from imitating. On this basis, they proposed that the dynamic capabilities of enterprises (i.e. unique process based capabilities formed based on current resource locations and historical paths) are the source of competitive advantage for enterprises (Fabrizio et al., 2022).

However, some scholars hold the opposite view, believing that dynamic capabilities themselves are not the source of a company's competitive advantage, but rather the resource structure allocated and adjusted by dynamic capabilities, which becomes the source of competitive advantage. For example, Zahra et al. (2006) argue that although dynamic capabilities have specificity in many details, there is significant consistency or similarity in dynamic capabilities between enterprises when analyzed based on some key features. Although

different enterprises have different starting points and paths for cultivating a certain dynamic capability, there is an industry's best standard for a certain dynamic capability. Therefore, in the end, different enterprises will tend to have similar levels of dynamic capability, making this dynamic capability no longer a source of sustained competitive advantage for the enterprise. In line with this, Finch et al. (2016) argue that dynamic abilities are imitable and can be developed through various learning pathways. There are commonalities between different enterprises and even different industries, therefore, dynamic capabilities themselves are not a source of long-term competitive advantage. With the emergence, collision, evolution, and disappearance of various market opportunities, dynamic capabilities have become a means of obtaining Schumpeter's rent, which can bring short-term competitive advantages to enterprises. Teece (2007) also found through empirical research that there are indeed commonalities in the dynamic capabilities of different enterprises.

Among which, Eisenhardt and Martin (2017) and Zollo and Winter (2002) explicitly pointed out that dynamic capabilities themselves are not the direct source of a company's competitive advantage. The resource optimization structure formed through the integration and reconstruction of dynamic capabilities is the true source of competitive advantage for the company. They put forward the above viewpoint because, on the one hand, in specific fields, especially in technology intensive industries, there are often clear best practice standards, technical guidelines, and industry norms within the industry. These publicly available information by enterprises provide a basis for various organizations to learn and refer to. In this situation, different organizations are easily guided by industry standards in the process of building and cultivating dynamic capabilities, resulting in high similarities and commonalities in key dimensions such as core components and operational models, but it is difficult to form unique differentiation advantages; On the other hand, technology intensive industries have a fast pace of technological iteration and a high degree of knowledge sharing. In the process of cultivating dynamic capabilities, it is difficult for enterprises to form a unique capability system, which further weakens the possibility of dynamic capabilities as a direct source of competitive advantage. At the same time, for enterprises that hope to have and maintain long-term competitive advantages in a fiercely competitive market environment, the guiding role of the market, the allocation of resources, and the impact of corporate strategic decisions cannot be ignored. Based on this, Jiao (2011) conducted extensive empirical research on the relationship between the dynamic capabilities of enterprises and their competitive advantages. The research results indicate that when enterprises have strong dynamic capabilities, they can more effectively respond to rapid market changes, technological innovation challenges, and industry

competition pressure, and thus achieve better results in new product and service research and development, as well as customer satisfaction improvement, ultimately promoting enterprises to gain competitive advantages. Dong et al. (2011) further deepened the relationship between dynamic capabilities and competitive advantages of enterprises. Research has found that dynamic capabilities have a positive impact on companies' ability to gain competitive advantage and play a significant role in the sustainability of competitive advantage. Specifically, possessing high-quality dynamic capabilities enables enterprises to adjust their resource allocation, strategic direction, and operational models in a timely manner when facing changes in the market environment, thereby maintaining the stability of their competitive advantage. In addition, the dynamic capabilities of enterprises can transform the new knowledge they continuously absorb into practical strategies, ultimately helping them gain a competitive advantage. Furthermore, from the perspective of resources and capabilities, for enterprises of different industries and scales, the impact of dynamic capabilities on their competitive advantage is more significant than the impact of the various resources they possess on their competitive advantage (Shu & Qiu, 2014). Because resources themselves have substitutability and imitability, but the dynamic capability of enterprises lies in their core ability to integrate and utilize resources, which can enable resources to exert greater value and have non replicability. Ge et al. (2017) affirmed the positive impact of dynamic capabilities on a company's competitive advantage in their study, and further revealed that the length of a company's lifespan can affect the effect of dynamic capabilities on competitive advantage. Enterprises with a long history of establishment often have accumulated rich operational experience, resource reserves, and organizational practices, which can provide better basic support for the effective play of dynamic capabilities. At the same time, dynamic capabilities can help enterprises cope with market competition pressure and transformation needs, and promote the optimization and development of enterprises.

Y. Wang and Wang (2017) explored the relationship between dynamic capabilities and competitive advantage from a new perspective. They believed that there is a substitute mechanism for dynamic capabilities in response to internal and external changes, which they named the "ad hoc problem solving" model. There are significant differences in cost structure between the two, so whether dynamic capabilities can bring competitive advantage to enterprises depends on the balance between investment costs and income. Wiklund and Shepherd (2005) found that the direction in which companies conduct change searches has a significant impact on performance differences, and small differences between companies can lead to significant performance differences.

Since dynamic capability has such an important impact on enterprise performance and competitive advantage, what factors affect and constrain dynamic capability? Many scholars are full of exploratory interest in this issue. Looking at the current main research literature, the study of the influencing factors of dynamic capabilities can be roughly divided into four types, as described below.

(1) Research based on resource foundation. King and Tucci (2002) study found that the accumulated experience of a company has a positive effect on its smooth entry into new niche markets. Wooten and Crane (2004) argue that human capital has a significant impact on dynamic capabilities, while Blyler and Coff (2003) argue that social capital is the core of dynamic capabilities. Adner and Helfat (2003) comprehensively examined various resource elements and concluded that dynamic capabilities are influenced by three potential factors: human resources, social capital, and management cognition. These three factors, acting alone or together, determine the strategic and operational management decisions of enterprises, and thus have a significant impact on dynamic capabilities.

(2) Research based on organizational methods. Teece (2009) found that top-level teams and their beliefs about organizational evolution play an important role in the formation of dynamic capabilities and the continuous evolution of corporate form. Dynamic capabilities depend on the learning process of emerging events and some basic rules in the process of organizational form evolution, as well as the support of top-level management teams. Therefore, they believe that in order for enterprises to cultivate dynamic capabilities, their organizational form must be decentralized and organic. Other scholars such as Rosenbloom have also summarized the impact of organizational factors such as management decision-making on dynamic capabilities based on the practices of different companies.

(3) Research based on technological means. Agrawal et al. (2021) studied the role of information and communication technology (ICT) and knowledge management systems (KMS) in the establishment, use, and maintenance of social networks between enterprises, and discussed the positive effects of ICT and KMS on the absorptive capacity (a type of dynamic capability) of enterprises.

(4) A combination study of the above aspects. Macher and Mowery (2009) studied the role of R&D organizational management processes and the application of information technology in improving process innovation performance of enterprises from three perspectives of learning (experience accumulation, knowledge expression, and knowledge coding). The results showed that the diversity of R&D team composition, the intensity of communication between R&D personnel and production personnel, and the wide distribution of information technology are

all conducive to enhancing the effectiveness of organizational learning and problem-solving. Adams and Lamont (2003) divided organizational resources into organizational learning based resources and capital based resources, emphasizing the impact of organizational learning capabilities on dynamic capabilities (especially innovation capabilities) of enterprises. They also explored the role of knowledge management systems in promoting the reconfiguration of resources in enterprises.

2.3.8 Dynamic capabilities in the field of medical services

(1) Research on the concept and evaluation indicators of medical service capability

Medical service capability is a concrete manifestation of a hospital's health service capability. Medical services are the core business provided by hospitals. Hospitals meet the needs of residents by providing high-quality medical services, and medical services can be a concrete manifestation of health service capabilities in hospitals. According to the definition of organizational capability, medical service capability refers to the ability of a hospital to utilize its own resources to provide high-quality medical services to residents in the region. The characteristics of high-quality medical services include effectiveness, high efficiency, accessibility, safety, patient acceptability, fairness, etc. The definition of medical service capability by the National Health and Family Planning Commission is: the medical service capability that meets the functional positioning of a tertiary hospital, including hospital resource allocation, technical personnel, work efficiency and effectiveness, medical remediation capability, and medical technology level. However, regardless of the direction of definition, medical service capability is based on safety and efficiency, utilizing relevant medical resources and technology to meet patients' medical needs.

Min (2017) established six core evaluation dimensions, including medical and health resource investment, service workload, service efficiency, diagnostic level, treatment effectiveness, and service safety, based on the definition of high-quality medical services by the World Health Organization (WHO) when constructing an evaluation system for the medical service capabilities of county-level public hospitals; J. S. Zheng et al. (2025) summarized the characteristics of China's medical service capacity in their research, which are as follows: overall, it shows a fluctuating growth trend, with significant regional differences, and its development level is closely related to the regional economic development level and government policy support. On the basis of drawing on existing research, this study, based on the principles of scientificity, rationality, and data availability, has selected and integrated the indicator evaluation system for the dynamic capability of medical services as follows: cross

functional team collaboration, allocation of medical resources, and external strategic alliances.

(2) The concept and dimensions of dynamic capabilities of medical consortium hospitals

The core idea of dynamic capability lies in the ability of enterprises to effectively adapt to changes in the external market environment, continuously integrate, build, and transform internal and external resources, in order to obtain and maintain sustainable competitive advantages. In recent years, with frequent adjustments to medical policies, accelerated technological iteration, and increasingly diversified patient needs, the uncertainty and complexity faced by the medical service system have significantly increased. The application of dynamic capability theory in hospital management research has also received widespread attention from scholars.

Najmi et al. (2018) defined hospital dynamic capability as the ability of hospitals to dynamically adjust organizational resources and processes based on environmental changes; Gifford et al. (2022) further emphasize that hospital dynamic capability is a systematic ability that hospitals must possess to maintain organizational flexibility in an increasingly uncertain and turbulent external environment. Specifically, it includes a keen perception of environmental changes, timely grasp of development opportunities, and the ability to upgrade and transform organizational structures and services. In terms of empirical research, the current application of dynamic capability theory in hospital management mainly focuses on two directions: hospital strategic management and performance management. In addition, multiple empirical studies have shown that the improvement of hospital dynamic capabilities not only helps enhance organizational operational agility and overall performance, but also demonstrates significant positive effects in promoting innovation in medical service models, optimizing diagnosis and treatment processes, and promoting the construction of smart healthcare systems. At present, different scholars have defined the dynamic capabilities of public hospitals. Although their perspectives are different, various viewpoints emphasize the hospital's response and adaptation to the dynamic environment, the integration of resources, and the ultimate goal of improving service efficiency and pursuing sustainable development. This is an organizational capability that enables hospitals to actively perceive the environment, flexibly integrate resources, and ultimately achieve service upgrading and sustainable development. Based on this, this article provides a definition of the dynamic capabilities of medical consortium hospitals: as an integrated medical service system, medical consortia respond to internal and external environmental changes, such as policy adjustments, technological innovations, changes in disease spectrum, and the upgrading of residents' health needs. Through the leadership of core hospitals and the collaborative mechanism of alliances, they continuously perceive and identify

opportunities and challenges, integrate and reconstruct dispersed resources within the system, including human resources, technology, information, etc., and promote organizational learning, flexible management, and service innovation, ultimately achieving high-level organizational capabilities such as overall service efficiency improvement, health outcome improvement, and system sustainable development of medical consortia.

In the development of dynamic capability theory, its connotation and dimension division have undergone continuous evolution and contextualization expansion. The initial researchers divided dynamic abilities into coordination ability, learning ability, and reconstruction ability, and later supplemented perceptual ability to construct the basic dimensional framework of this theory. Subsequently, Pavlou and El Sawy (2011) further introduced integration capabilities in their research, emphasizing the effective integration and integrated use of resources by organizations in dynamic environments, thereby deepening the operational connotation of this theory. In domestic research, J. Zhang and Sun (2019) proposed a four-dimensional dynamic capability structure applicable to medical institutions, based on the organizational characteristics of public hospitals, including perception and recognition, coordination and integration, flexible management, and improvisation capabilities. With the rapid penetration and continuous emergence of innovative applications of digital technology in the medical field. Deng et al. (2023) further proposed in their research that innovation capability should be explicitly included in the dynamic capability system of public hospitals to systematically respond to technological changes, promote service model transformation, and shape the core advantages of sustainable development.

(3) Research on dynamic capabilities in the field of medical services

Dynamic capability, as a core research direction in the field of strategic management, is essentially formed through the systematic integration, active construction, and flexible reconstruction of internal and external resources owned by the organization, to effectively respond to the uncertainty of complex and changing environments. Driven by both theoretical research and practical application, the application scenarios of dynamic capabilities have gradually expanded from traditional fields to emerging fields. Initially, the application scenarios of dynamic capabilities were mainly concentrated in traditional manufacturing industries, such as automobile and machinery manufacturing, which rely on large-scale production and resource allocation, and traditional service industries. Later, they gradually extended to the more specialized and complex medical and health fields. The application scenarios of dynamic capabilities are gradually extending from traditional manufacturing and service industries to the medical field. According to the research of Min (2017), it was not until 2005 that the application

of dynamic capabilities in the medical field gradually emerged, becoming an emerging research direction with both theoretical value and practical significance, providing a new theoretical perspective for solving problems such as resource integration and efficiency improvement in the development of the medical industry. Studies have shown that in the continuous transformation and development of the healthcare industry, the cultivation and development of dynamic capabilities have played a significant role in promoting the iterative upgrading of health information technology, and the improvement of health information technology has further benefited medical institutions, helping them achieve breakthroughs in optimizing service quality and improving operational efficiency (Leung, 2012). The development of big data has promoted the dynamic capabilities of the medical industry. The traditional business model of the medical industry is mainly based on offline diagnosis and treatment, and resource allocation presents passive response characteristics, making it difficult to quickly adapt to the dynamic changes in patient needs and the optimization of medical resource allocation requirements. Against the backdrop of the development of big data technology, dynamic capabilities have provided medical institutions with the possibility of proactive services: medical institutions can use dynamic capabilities to integrate multi-channel medical data resources, such as patient health record data, diagnosis and treatment process data, public health testing data, etc., and use big data analysis technology to explore patients' potential health needs, predict disease trends, and launch proactive health management services, thus providing a new business model for the medical industry (Pundziene et al., 2019). With the intensification of natural environmental problems such as air pollution and frequent extreme weather, the survival challenges faced by medical institutions in operation have surpassed the technical and market levels, and extended to the field of ecological resource constraints. The development of dynamic capabilities can effectively alleviate the challenges brought by ecological resource constraints, and its impact on medical institutions is mainly reflected in three levels: human resources, relationships, and ecology (Maleki & Shabani, 2019). Research has shown that dynamic capabilities play an important role in transforming knowledge resources into innovation in the healthcare industry (Edgar et al., 2024). As a typical knowledge intensive industry, the innovation and development of the medical industry mainly rely on knowledge resources such as clinical experience, scientific research achievements, and technology patents. However, knowledge resources themselves are relatively scattered and exhibit invisible characteristics. The development of dynamic capabilities provides path support for the transformation and innovation of knowledge resources, which is of great significance in the innovation process of the medical industry.

2.4 Theory of "technology organization environment"

2.4.1 Concept and theoretical development

The TOE theory, also known as the "Technology Organization Environment" framework, was first proposed by Tornatzky and Fleischer in the book "Processes of Technological Innovation" in 1990. This theory proposes that three major factors, namely technological characteristics, internal organizational attributes, and external environment, can all affect users' acceptance of innovative technology. It is a fundamental and far-reaching theoretical model in the field of innovative technology adoption and diffusion, aiming to systematically analyze a series of internal and external factors that affect organizations (especially enterprises) to adopt and implement technological innovation.

(1) Technical dimension

Based on the theory of diffusion of innovation (DOI), when the TOE theory was first proposed, its technical perspective focused on the inherent attributes of innovative technologies, including: relative advantage (the efficiency, cost, or functional advantages of new technologies compared to existing technologies), compatibility (the degree of matching with existing technologies, processes, and values of the organization), complexity (the difficulty and understanding threshold of technology operation), trialability (the feasibility of small-scale pilot testing), and observability (the convenience of perception and evaluation of implementation effects), emphasizing the direct impact of technology characteristics on the adoption decisions of enterprises.

In the 2000s, as research deepened, scholars discovered the crucial role of organizational technological foundations in technology adoption. Venkatesh et al. (2003) proposed a new technological characteristic in the UTAUT model - convenience conditions (emphasizing organizational resources and technological infrastructure support). After being introduced into the TOE framework, this feature drives the expansion of technological factors into two dimensions: technological infrastructure (the organization's existing IT hardware, software, and network environment, such as whether the enterprise has computing power resources to support AI applications) and organizational technological capabilities (the technical knowledge and application capabilities of organizational members, such as employee digital literacy). Through further research, K. Zhu et al. (2006) subdivided technical capabilities into IT infrastructure and network skills in the study of e-commerce adoption, confirming that both jointly affect the effectiveness of technology implementation. This expansion shifts TOE from simply focusing

on technical characteristics to analyzing the interaction capabilities between technology and organizations.

In the mid to late 2010s, the research focus shifted from technology itself to organizations' ability to integrate and manage technology. In the study of local government websites by Tan et al. (2019), the core role of "technical management capability" was emphasized on the basis of "technical facilities", indicating that the value of technical factors is no longer limited to adoption, but rather lies in the ability of organizations to effectively operate and transform them through professional teams or service outsourcing. Entering the 2020s, technological factors have evolved into the fundamental support for ensuring system operation in the context of digital governance. When studying digital government security, X. X. Wang and Dong (2025) concretize technological factors into "technological infrastructure" and "data openness capability", whose value lies in balancing security and efficiency. Technology has become a key pillar to ensure the stable operation of the governance system. By 2025, from the perspective of innovation ecology, the connotation of technological factors has undergone fundamental restructuring. When studying artificial intelligence enterprises, He and Jing (2025) explicitly define technological factors as "technological relationships", including "technological complementarity" and "technological proximity". This marks a shift in the core advantage of technology from internal physical assets to the strength and manner of knowledge connections with partners in the innovation ecosystem, with the core being the dynamic relationship network that drives disruptive innovation.

(2) Organizational dimension

In the early stages of the theory proposed in 1990, organizational factors focused on the structural characteristics within the organization, specifically including four types of elements: organizational size and scope, IT infrastructure, management structure, and human resource status. These elements constitute the fundamental conditions for organizational technology adoption. In the 2000s, organizational factors expanded towards the dimensions of capability and resources. As research deepens, scholars have found that the dynamic capabilities of organizations are crucial for technology adoption. Venkatesh et al. (2003) introduced the concept of "facilitation conditions" in the UTAUT model into the TOE framework, which promotes the expansion of organizational factors into three core dimensions: top management support, technological experience and learning ability, and organizational innovation culture. K. Zhu et al. (2006) confirmed that the level of attention given by senior management to e-commerce directly affects the effectiveness of technology implementation; Additionally, some scholars have found that companies with a strong culture of innovation have a higher

willingness to adopt emerging technologies. The expansion of this stage shifts the focus of TOE theory from simply focusing on static structures to the interaction capabilities between organizations and technology, which can explain the process of integrating internal and external resources to adapt to technological changes through dynamic capability theory.

Since the 2010s, digital transformation and the formation of complex technological ecosystems have driven organizational factors to evolve towards ecological collaboration and dynamic adaptation. The organizational factors in this stage mainly include three core contents: firstly, inter organizational collaboration mechanisms, covering supply chain integration with upstream and downstream enterprise technology collaboration, as well as R&D cooperation networks that obtain complementary knowledge through industry university research cooperation. For example, the application of the Internet of Things in the supply chain needs to be compatible with supplier systems, and artificial intelligence enterprises often break through technological bottlenecks through cooperation with universities; The second is dynamic capability and organizational resilience, including the ability to quickly adjust resources to respond to environmental changes through resource restructuring, as well as the digital maturity of measuring the depth of digital technology embedded in business processes. Digital native enterprises demonstrate stronger innovation vitality due to their high level of digital maturity; The third is stakeholder participation, which is reflected in the public management field as citizen and user participation that balances citizen needs and digital literacy. For example, urban digital twin technology needs to optimize its functions through public feedback. At the enterprise level, it is manifested as employees' acceptance and ability to use new technologies. For example, AI tool promotion needs to be accompanied by training to reduce technology anxiety. In the process of theoretical evolution, several scholars have made key contributions: Forrest (1991) laid the foundation for the original organizational factors; K. Zhu et al. (2006) introduced high-level support and technical experience, emphasizing the role of organizational resources; The dynamic capability theory proposed by Teece (2007) promotes the expansion of organizational factors towards resource integration and environmental adaptation; Scholars have emphasized the importance of innovation mechanisms and ecological collaboration, and proposed that organizations need to have cross-border integration capabilities; Bui and Le (2025) incorporate the stakeholder dimension into the framework, enriching the ecological perspective.

(3) Environmental dimension

The initial environmental factors focused on the macro background outside the organization, mainly including basic external factors such as market competition pressure, government policies and regulations, and social and cultural values. The theoretical depth of this framework

has been significantly expanded after the introduction of institutional theory. The institutional isomorphism theory proposed by Dimaggio and Powell (1983), particularly the triple mechanism of coercive, normative, and imitative pressures, provides a core theoretical basis for understanding the sources of environmental pressures. Subsequently, Gibbs and Kraemer (2004) operationalized this theory in a comparative study of e-commerce adoption between developed countries and emerging economies, explicitly stating that institutional barriers (such as inadequate legal frameworks) and government promotion policies are key environmental variables that lead to differences in cross-border adoption, thus enriching the environmental dimension of TOE at the empirical level.

In the 2010s, as information technology moved towards cloudification and platformization, the focus of research on environmental factors began to shift from macro institutional environments to the relationship networks and digital ecosystems in which organizations operate. For example, Oliveira and Martins (2011) confirmed in their study of cloud computing adoption in European countries that the electronic readiness of trading partners creates significant external pressure and motivation for businesses. Subsequently, numerous studies on the adoption of ERP and SaaS, such as Hung et al. (2012), have repeatedly validated the crucial role of intermediaries such as consultants and solution providers in technology promotion. The rise of the platform economy has further extended the boundaries of the environment. Scholars such as Cristobal-Fransi et al. (2019) have found that in the context of mobile payments and O2O services, the intensity of platform competition and the complementary innovation of ecosystem partners have become indispensable environmental factors, marking the evolution of the environment from a static background to a dynamic interactive ecological network.

In recent years, research on environmental factors has shown a highly contextualized and dynamic trend. Bui and Le (2025) introduced novel dimensions in their research on urban digital twin technology, such as “political influence” (referring to the game between political leaders’ will and local interests that goes beyond conventional policies) and “citizen technological experience” (the public’s familiarity and acceptance of underlying technologies). Zhou and Li (2025) innovatively proposed the concept of “environmental resilience” in response to the complex public opinion environment faced by international communication platforms, emphasizing the need for platforms to build a three-level response mechanism that includes early warning, buffering, and repair to cope with sudden impacts.

(4) TOE theory and dynamic capability research

The dynamic market environment may turn an organization’s advantageous resources into disadvantageous resources. Organizations need to continuously develop resources to gain long-

term advantages and competitiveness in the market. Dynamic capabilities can solve the problem of developing, deploying, and protecting the combination of resources and capabilities needed by organizations to adapt to changes in the market environment (Ellström et al., 2021). In order to enhance competitiveness, organizations need the dynamic ability to perceive, capture, and reconfigure resources. Perception is understanding the market environment in which the organization operates, potential customers, competitors, and partners; Capturing means seizing innovative opportunities and creating value; Reconfigure is to adapt an organization's resources and structure to the constantly changing market environment in order to maintain competitiveness (Linde et al., 2021). The Fourth Industrial Revolution has greatly influenced the development of the medical industry, and advanced medical technology will provide better, faster, and more effective treatment and services for patients (Haleem et al., 2022). With the development of information technology, big data technology has been widely applied in various fields. In the field of medical services, big data technology not only helps to improve the efficiency and quality of medical services, but also promotes the development of the medical industry (Khalid & Qinqin, 2024). In the context of data-driven development, advanced medical technology can enhance treatment and services, digital technology empowered medical equipment can better meet the needs of patients, and digital medical facilities can more effectively detect and treat diseases, thereby improving medical services (Haleem et al., 2022). However, the above research only studies the dynamic capabilities of medical services from a single dimension. In fact, based on the TOE theory, technological factors, organizational factors, and environmental factors will all have an impact on it under the data-driven background. In the context of data-driven development, healthcare services face organizational challenges, technological and infrastructure barriers, as well as potential obstacles at the environmental level such as individual needs and perceptions (Mbunge et al., 2021). Therefore, based on the TOE theory, this article explores the synergistic effect of technology - organization - environment factors on the dynamic capabilities of medical services.

2.4.2 Technical factors and dynamic capabilities

Technological progress is the key to medical innovation, and any advancement in medical services requires strong technological infrastructure support. These technologies are the key to effective communication between patients and medical professionals (Ogundele et al., 2018). Driven by digital innovation technology, doctors and experts can better maintain remote communication, innovate medical service solutions, and enhance patients' happiness and satisfaction (Pang et al., 2018). Digital innovation in the field of medical services can improve

accuracy and efficiency, he integration of new technologies into healthcare services—strengthening the convergence of medical care, health management, and technology—boosts the ability to effectively detect and treat diseases (Javaid et al., 2020). The sharing of patient data in digital medical facilities enables real-time monitoring and care of patients (Jaleel et al., 2020). Medical equipment systems based on information technology and communication technology can provide higher levels of quality and security for medical service processes (Celdrán et al., 2018). Based on this, this article regards digital innovation capability and digital infrastructure development as key factors affecting the dynamic capability of medical services in the technological dimension. The former refers to the ability of hospitals to innovate and optimize medical service processes using digital technologies such as big data, artificial intelligence, cloud computing, etc. The latter refers to hospitals deploying intelligent hardware devices, digital systems, digital information platforms, etc. based on advanced digital technologies to build an efficient, secure, and interconnected medical data environment.

Digital Innovation Capability: Digital innovation refers to the creation or adoption of new things with added value through the integration of digital technologies (Kroh et al., 2024). In the process of enhancing the dynamic capabilities of medical services, digital innovation relying on information technology can enable organizations to acquire new knowledge and skills to customize new products or services, as well as create value (Hinings et al., 2018). On the one hand, driven by data, digital innovation technology can make it more convenient for organizations to collect, process, analyze, and store data, thereby strengthening the integration of service data; On the other hand, digital innovation can enable organizations to improve value creation, enhance customer feedback, and ultimately make better service decisions (Edu et al., 2020).

Digital Infrastructure Development: Digital infrastructure is the collection of technologies, networks, systems, and processes that operate information systems, promoting innovation and new business opportunities for enterprises (Henfridsson & Bygstad, 2013). The deployment and adoption of the commercial Internet has brought about a huge restructuring of digital infrastructure, which is now the basis for supporting a series of innovative businesses of the organization (Greenstein, 2019). In the context of data-driven development, the construction of digital facilities in hospitals is the foundation for meeting medical needs and promoting the improvement of medical services (Nataliia et al., 2021). The construction of high-quality digital facilities driven by data can easily access medical services through physical or virtual means, thereby effectively improving the accessibility and quality of medical services (Le et al., 2022).

2.4.3 Organizational factors and dynamic capabilities

Under the driving force of digital technology, organizations need to quickly adjust their direction, prepare for new technologies, and develop towards them. The support of organizational leaders for digital technology (such as adoption or innovation) is crucial (Salman et al., 2024). Furthermore, the introduction of digitalization and digital devices, as well as the construction of algorithm models, can solve problems such as long waiting times, difficulty in detecting important indicators, and delayed assistance in medical services (Ilin et al., 2024). Accurate medical data collection, analysis, electronic medical records, remote medical methods, etc. relying on data technology can promote individual and community health services (Kraus et al., 2021). Based on this, this article regards organizational digital concern and digital resources supply as key factors that affect the dynamic capabilities of medical services in the organizational dimension. Organizational digital concern refers to the ability of senior hospital managers to continuously focus on and integrate digital medical technology, medical data, and digital innovation. Digital resources supply refers to hospitals supporting the operation of digital medical services and the adoption of digital innovation technologies, providing sustained investment and configuration capabilities in digital hardware equipment and network infrastructure.

Organizational digital concern: Attention refers to the process in which organizational leaders selectively focus on certain information (Simon & Behavior, 1957). Organizational digital concern is a dynamic process in which organizations, in a data-driven context, systematically screen digital resources for information, integrate knowledge, and transform actions (Yaniv & Schwartz, 2011). Organizational attention is a cognitive form that serves as a bridge between organizational cognition and organizational behavioral decision-making, and can further drive organizational action (R. R. Ren et al., 2024).

Digital resources supply: Digital resources based on information technology and information systems are becoming increasingly popular in providing medical services (Anthony, 2021). Hospitals providing various channels of medical digital resources such as remote diagnosis and treatment platforms, digital medical workstations, etc. can enhance the benefits of digital services for vulnerable groups, thereby improving the quality of medical services (Kaihlanen et al., 2022). Medical digital resources can significantly optimize the treatment process, improve treatment efficiency, enhance patient satisfaction, and reduce medical costs (Senbekov et al., 2020).

2.4.4 Environmental factors and dynamic capabilities

Putting patient needs at the center is the task of medical services, not only based on disease needs but also on non clinical needs identified through medical experience judgment (Waelli et al., 2021). Optimizing around the needs and priorities of patients is an important means to enhance the potential of healthcare services (Meskó & Debronkart, 2022). Meeting the medical needs of patients can optimize the treatment decision-making process and provide better medical services (Visser et al., 2020). At the same time, the improvement of service quality by competitors in the same industry will promote the enhancement of medical service capabilities for enterprises (Bhatia & Kumar, 2022). Based on this, this article considers the medical demand satisfaction and peer competition pressure as key factors affecting the dynamic capabilities of medical services in the environmental dimension. The former refers to the ability of hospitals to meet or exceed patients' expectations by providing high-quality diagnosis and treatment services, humanized doctor-patient interaction, and efficient resource allocation. The latter is the challenging external driving force brought about by similar competitors taking more proactive actions in digital driven services, technological innovation, and patient experience optimization during the development of digital medical services in hospitals.

Medical demand satisfaction: Satisfying needs is a necessary service in the medical process, and when patient needs are not met, it will reduce individual satisfaction with the medical service and thus affect the quality of medical services (L. Chen, 2025). The medical needs of contemporary patients are diversified, and more attention is paid to the progressiveness of equipment, professionalism of medical care, etc. So meeting the medical needs of patients is the standard of medical service quality, and is also one of the key factors to improve the medical service ability (H. M. Yu & Tong, 2023).

Peer competition pressure: Closely monitoring the activities and strategies of competitors in the same industry is the main factor for enterprises to survive and maintain competitiveness in the market (Narver & Slater, 1990). The specific behavior of competitors will prompt companies to make corresponding competitive responses (Bhatia & Kumar, 2022). So the improvement made by competitors in medical service capabilities will encourage West China Medical Alliance Hospital to innovate and enhance its medical service capabilities.

2.5 Literature review

Previous studies have systematically sorted out the relevant concepts, classification

characteristics, and domestic and international implementation models of medical consortia. At the same time, dynamic capabilities have been explored from the development of concepts, characteristic attributes, influencing factors, and preliminary applications in the medical field. Based on the theory of "technology organization environment", the impact of these three factors on the dynamic capabilities of medical services has been preliminarily analyzed, laying a theoretical and practical foundation for subsequent research. However, existing research still has significant shortcomings, neglecting the configurational study of the dynamic service capabilities of medical consortia.

Firstly, there is a serious lack of targeted exploration of the dynamic capabilities of medical consortia in existing research. Most studies only apply the theory of dynamic capabilities broadly to the level of "medical institutions" or "medical industries", without considering the special nature of medical consortia as multi-party collaborative organizations. Medical consortium organizations involve resource linkage among different levels and types of medical institutions, and their medical dynamic capabilities not only include the resource integration ability of individual institutions, but also involve the resource reconstruction ability across institutions. However, the existing research on these aspects is still unclear.

Secondly, in the joint research of technology organization environment theory and dynamic capabilities of medical consortia, more studies only explore the impact of dynamic capabilities from a single dimension. For example, some studies only focus on the application of digital technology in medical diagnosis, analyze the impact of digital technology (electronic medical records, enterprise resource planning, and IoT medical wearable devices) on medical integration processes, and further analyze the impact of digital technology on dynamic capabilities such as quality, agility, and responsiveness (Chakravorty et al., 2020). Some studies only explore its impact on dynamic capabilities from an organizational perspective, examining the dynamic capabilities present in public health sector organizations and analyzing how organizations can establish dynamic capabilities to maintain good performance levels (Loureiro et al., 2023). However, there has been no in-depth exploration of the interaction mechanism between technology, organization, and environment in the context of medical consortia.

Overall, current research lacks systematic configuration studies on the dynamic capabilities of medical consortia based on the characteristics of the organization and the theory of technology organization environment. There is no complete research chain that includes theoretical framework, influence mechanism, configuration studies, and differentiation strategies. Therefore, combining the TOE theory to construct a multidimensional and multi-party research system for the dynamic capabilities of medical services, in-depth study of the

synergistic interaction between technology, organization, and environment, and exploration of configuration adaptation paths to enhance the dynamic capabilities of medical services in medical consortia, in order to provide theoretical support and practical paths for the sustainable development of medical consortia.

The research framework diagram of this study is shown in Figure 2.4.

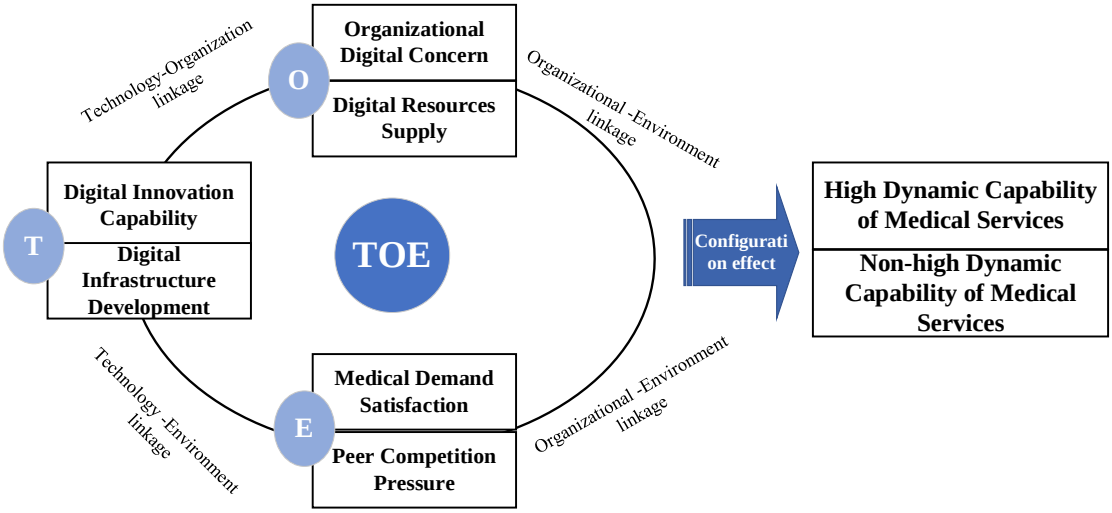


Figure 2.4 Research framework diagram

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Chapter 3: Research Design

This chapter introduces the methodology of this study. It elaborates on the selection of research subjects, variable measurement, and pilot testing procedures, and discusses data collection and sample characteristics.

3.1 Methodology

This study focuses on improving the dynamic capabilities of medical services in West China Hospital Alliance hospitals within a data-driven context and adopts the fsQCA method to conduct the research.

From a research perspective, the TOE theory was applied to identify six antecedent factors across three dimensions. The technological dimension included digital innovation capability and the development of digital infrastructure. The organisational dimension included organisational digital concern and digital resource supply. The environmental dimension included medical demand satisfaction and peer competition pressure. These six factors were treated as antecedent conditions affecting the dynamic capabilities of medical services in Chinese Western medicine joint venture hospitals, with high and non-high dynamic capability as the outcome variables. Subsequently, 116 joint Chinese Western medicine joint venture hospitals were selected as research subjects, and relevant data were collected.

In terms of research content, the fsQCA method was used to analyse how different configurations of antecedent conditions influence the dynamic capabilities of medical services and to identify multiple configuration pathways through which West China Hospital Alliance Hospital can improve its dynamic capabilities.

The application of the fsQCA method is appropriate for this study's objectives. The enhancement of dynamic capabilities in medical services is a complex process arising from the combined effects of TOE factors and involves multiple causal relationships. Different combinations of antecedent conditions may lead to the same outcome, namely, high dynamic capabilities in medical services. The fsQCA method is effective in addressing this type of complex causal configuration while retaining sensitivity to qualitative complexity and maintaining the systematic and rigorous attributes of quantitative analysis. The technique is therefore suitable for investigating dynamic capability enhancement in West China Hospital

Alliance hospitals and provides strong support for the development of the research theoretical framework and practical recommendations.

3.2 Research object selection

Based on work experience and available resources, and following discussions within the research group, this study selected West China Hospital, a medical consortium hospital, as the research object. The specific details are presented below:

(1) Introduction to West China Hospital

West China Hospital was founded in 1892, and the West China Clinical Medical College originated from West China Union University Medical College in 1914. It has developed into a national centre for the diagnosis and treatment of complex and critical illnesses in western China, a leading medical education institution, and a national-level base for medical scientific research and technological innovation. Its comprehensive strength ranks among the leading hospitals in China and is considered internationally advanced. It is one of the first designated national medical centre creation units and a pilot hospital for high-quality development jointly supported by the national commission and the provincial government. The hospital has established two national regional medical centres. West China Hospital, together with Peking Union Medical College Hospital, Xiangya Hospital of Central South University, and Qilu Hospital of Shandong University, is recognised as one of China's Four Pillars of Healthcare, derived from the widely recognised expression North Union, South Xiangya, West Huaxi, East Qilu, and occupies a pivotal position within China's healthcare system.

(2) Medical consortium units of West China Hospital

The medical consortium approach is a standard organisational model used by Chinese medical institutions to integrate and share resources. A medical consortium hospital is a collaborative network of medical institutions at different levels and types that enhances regional healthcare efficiency through mechanisms such as resource sharing and technical assistance. The core objective is to promote hierarchical diagnosis and treatment and to optimise medical resource allocation.

Medical consortium units of West China Hospital typically take tertiary hospitals as the core and collaborate with grassroots institutions, including secondary hospitals, community health service centres, and township health centres, to form a collaborative system encompassing management, technology, and service functions. According to the form of cooperation, medical consortia are classified as tight type, characterised by unified management

of personnel, assets, and finances, and loose type, which is based on cooperative agreements. These member hospitals operate around West China Hospital as the central institution, sharing its medical resources while retaining independent operational capacities.

(3) Sample selection criteria

The selection of West China Hospital Alliance units for this study was based on the following considerations:

Firstly, data availability was high. The author works at West China Hospital, which facilitated convenient access to data related to the West China Hospital Alliance. Strong support was also provided by senior hospital management.

Secondly, the research design required access to interview materials and internal information for multi-dimensional data verification. Qualitative comparative analysis necessitates path analysis of specific cases. Using data from West China Hospital Alliance units enabled the author to conduct interviews, collect internal information, and cross-validate findings from multiple perspectives.

Thirdly, the West China Hospital Alliance units are typical and representative. Huaxi Hospital ranks among the leading hospitals in China and is often considered among the top three nationwide. Together with its consortium hospitals, it plays a critical role within the national healthcare system and demonstrates high typicality and representativeness. Therefore, research based on the West China Hospital Alliance provides a valuable reference for studies of medical consortia development.

3.3 Variables measurement

All variables in this study were measured on a five-point Likert scale, where 1 = disagree entirely and 5 = completely agree.

(1) Dynamic capability of medical services

The dependent variable of this study is the dynamic capability of medical services. According to the study by Scuotto et al. (2024) , the dynamic capability of medical services comprises three dimensions: cross-functional team collaboration, strategic allocation of medical resources, and external strategic alliance cooperation. During item development, appropriate modifications were made to reflect the practical conditions of West China Hospital Alliance units, yielding 9 measurement items. These items include the proportion of cross-functional teams formed by hospitals that involve professionals from multiple fields, including clinical medicine, information technology (IT), and patient experience management, relative to

the planned number of teams. The proportion of actual working time invested by cross-functional team members during medical service product development relative to the total project development time was measured. The proportion of newly developed and implemented diagnosis and treatment solutions, digital medical service platforms, and other medical service products created by cross-functional teams relative to the total number of projects undertaken by those teams was assessed. The actual level of resources obtained by hospitals, including medical equipment procurement, research funding, and training resource allocation for medical staff, was measured relative to planned acquisition levels. The allocation ratio of medical resources across different innovative projects and the degree of matching between project requirements. The ratio of medical resources invested to the output of innovation projects was evaluated. The number of strategic alliances newly established by hospitals with other medical institutions, research institutes, technology enterprises, and related organisations, and the growth rate relative to the previous period were assessed. The proportion of new patient groups or medical market sectors reached through the successful promotion and application of new medical service products, including new diagnostic technologies and remote medical services developed through external strategic alliances, relative to the total number of collaborative research outcomes, was measured. The contribution of advanced medical technologies, scientific research outputs, professional talent, and other resources introduced through strategic alliances to the development of medical service innovation projects and improvement in medical service quality was also assessed.

The specific measurement items are shown in Table 3.1

Table 3.1 Dependent variable measurement items

Variable	Dimension	Measurement items	Item number	References
Dynamic capability of medical services (DC)	Cross functional team collaboration	1. The proportion of cross functional teams formed by hospitals that include professionals from multiple fields such as clinical medicine, information technology, and patient experience management to the planned number of teams.	DC1	Scuotto et al. (2024)
		2. The proportion of actual work time invested by cross functional team members in the development process of medical service products to the total project development time.	DC2	
		3. The proportion of new diagnosis and treatment solutions, digital medical service platforms, and other medical service products developed and put into use by cross functional teams to the total	DC3	

	number of projects undertaken by the team.	
Strategic allocation of medical resources	4. The actual amount of resources obtained by the hospital in terms of medical equipment procurement, research funding investment, and allocation of training resources for medical staff has reached the planned amount.	DC4
	5. The allocation ratio of medical resources among different innovative projects and the matching degree of project requirements.	DC5
	6. The ratio of medical resources invested to the output of innovative projects.	DC6
External strategic alliance cooperation	7. The number of strategic alliances newly established by hospitals with other medical institutions, research institutes, technology enterprises, etc., and the growth rate compared to the previous period.	DC7
	8. The proportion of successful promotion and application of new medical service products (such as new diagnostic technologies, remote medical services, etc.) developed by hospitals in cooperation with external strategic alliances to new patient groups or medical market fields, compared to the total number of joint research and development achievements.	DC8
	9. The contribution of advanced medical technology, scientific research achievements, professional talents and other resources introduced by hospitals through strategic alliances to the development of medical service innovation projects and the improvement of medical service quality.	DC9

(2) Digital innovation capability

Digital innovation capability is an independent variable in this study. As noted by Rajapathirana and Hui (2018) , digital innovation capability was measured across three dimensions. These include creating a culture within the West China Hospital Medical Consortium that encourages digital innovation, tolerates trial and error, supports regular discussions and exchanges on digital innovation, and fosters high levels of employee participation in digital innovation projects. During the promotion of digital innovation, the West China Hospital Medical Consortium integrates multiple types of knowledge, including clinical medical data knowledge, professional expertise in IT, and knowledge derived from patient

feedback, to optimise digital medical services. Within digital innovation projects undertaken by the West China Hospital Medical Consortium, medical staff and technical personnel are deeply involved in system development and process optimisation. At the same time, the needs and suggestions of customer groups, including patients and their families, are actively collected and incorporated into digital innovation practices.

(3) Digital infrastructure development

Digital infrastructure development is an independent variable in this study. Referring to Z. Y. Du and Wang (2024) and N. Li (2024) , this study measures digital infrastructure development across four aspects. The digital storage systems of West China Hospital Alliance hospitals are capable of efficiently storing and processing large volumes of medical data, and their storage capacity can meet future growth demands for hospital big data, including the unified storage of electronic medical records, log files, and medical imaging data. Data processing platforms possess strong computing capabilities and can rapidly complete big data analysis tasks to meet operational and patient service needs. The various digital information platforms of West China Hospital Alliance hospitals enable seamless integration of multisource data, including data from electronic medical record systems, medical imaging systems, and laboratory information systems, thereby ensuring accurate and real-time data synchronisation across systems. Data sharing interfaces support information exchange with regional medical information platforms and scientific research institution data platforms, enabling wider-scale sharing of medical data; West China Hospital Alliance hospitals are equipped with professional data analysis tools and algorithm models that enable in-depth exploration of medical data, including analysis of patient disease history, treatment plans, and recovery status. These analytical outcomes are applied effectively to hospital management, such as improving service processes based on patient satisfaction data. The West China Hospital Alliance hospitals have established comprehensive data security management systems that strictly control data collection, storage, transmission, and use. Advanced data encryption technologies are employed to prevent data tampering during transmission and storage and to protect patients' personal information and medical data from unauthorised disclosure during data analysis and data sharing.

(4) Medical demand satisfaction

Medical demand satisfaction is an independent variable in this study. Referring to Cambra-Fierro and Polo-Redondo (2008) , medical demand satisfaction was measured across three aspects. These include the extent to which the West China Hospital Medical Consortium effectively fulfils its commitments to patients at the initial stage of service delivery, such as

providing accurate and efficient diagnoses, personalised treatment plans, and timely allocation of medical resources. During the process of receiving medical services within the West China Hospital Medical Consortium, patients experience positive interactions and relationships with medical staff and service personnel at all levels of the consortium, and feel respected, cared for, and professionally treated. Compared to patients' ideal expectations for medical service delivery, overall satisfaction was assessed regarding how well the West China Hospital Medical Consortium meets individual medical needs, including disease diagnosis and treatment, rehabilitation nursing, and health guidance.

(5) Peer competition pressure

Peer competition pressure is an independent variable in this study. As reported by Bhatia and Kumar (2022) , peer competition pressure was measured across four aspects. In data-driven medical services, competitors of the West China Medical Alliance Hospital have adopted more extensive measures to optimise medical processes and improve service quality through data utilisation. Competitors are more actively investing in data-driven medical services, using data analysis to support diagnosis and deliver more precise health management solutions, and have achieved greater benefits, including increased patient satisfaction and reduced medical costs. Through data-driven approaches, competitors have achieved service innovation, such as providing personalised medical services and improving patient experiences, resulting in favourable reputations and greater recognition among patients. Competitors that adopt data-driven medical service models have significantly enhanced their competitiveness in the healthcare market and attracted more patients seeking medical treatment.

(6) Organizational Digital concern

Organisational digital concern is an independent variable in this study. Referring to F. Yu et al. (2021) , the organisational digital concern was measured across four aspects. These include the extent to which the core management team of the West China Hospital Medical Consortium values knowledge and information related to leading digital healthcare technologies, medical data security policies, and related areas, regarding these as key elements for promoting the development of medical consortia. The extent to which the core management team regularly considers integrating knowledge and information, including medical big data analysis technologies and AI-assisted diagnostic systems, to optimise internal diagnosis and treatment processes and enhance patient services within the consortium was assessed. The degree to which the core management team actively interprets national digital healthcare development policies, industry digital transformation standards, and related knowledge resources, and derives development directions and strategies suitable for medical consortia

from these inputs was measured; The final aspect assessed the extent to which the core management team invests time and effort in studying, analysing, and tracking knowledge and information related to digital medical innovation technologies and collaborative data sharing models within medical consortia.

(7) Digital resources supply

Digital resource supply is an independent variable in this study. Referring to Szopa and Cyplik (2020) , digital resource supply was measured across five aspects. The first aspect examined the expenditure of the West China Hospital Medical Consortium on hardware equipment procurement, including intelligent diagnosis and treatment terminals and data centre servers. It also examined spending on software and IT services, including medical data analysis software and system operation and maintenance services, as well as telecommunications network construction, including 5G medical private networks and dedicated data transmission lines. These investments were assessed to determine whether they fully meet the consortium's digital resource supply needs. The second aspect assessed whether the digital hardware assets, including intelligent surgical equipment and regional inspection automation instruments, and professional medical software, including electronic medical record systems and remote consultation platforms, used by the West China Hospital Medical Consortium, ensure an adequate digital resource supply in terms of quantity and functionality. The third aspect evaluated whether the digital technology equipment, including mobile ward round systems and portable diagnostic devices, software and IT services, including medical application authorisations and cloud storage services, and telecommunications support resources, including workflow packages and remote collaboration networks, provided to each employee is sufficient to meet daily digital work requirements. The fourth aspect compares current conditions with the previous year to assess whether digital hardware assets, including upgraded monitoring equipment and newly introduced IoT terminals, and software assets, including new AI diagnostic systems and upgraded patient management software, available to employees, have increased in value and functionality, thereby enhancing digital resource supply capabilities. The fifth aspect examined whether the proportion of standardised digital workstations, which integrate multiple medical systems and support real-time data sharing, across medical institutions within the West China Hospital Medical Consortium meets operational demands for digital medical services and the supply of digital resources.

The specific measurement items are shown in Table 3.2.

Table 3.2 Independent variable measurement items

Variable	Measurement items	Item number	References
Digital innovation capability, DIC	1. The West China Hospital Medical Consortium has formed a cultural atmosphere that encourages digital innovation and tolerates trial and error. Regular discussions and exchanges related to digital innovation are held, and employees have a high enthusiasm for participating in digital innovation projects.	DIC1	Rajapathirana and Hui (2018)
	2. In the process of promoting digital innovation, the West China Hospital Medical Consortium fully integrates multi-source knowledge such as medical clinical data knowledge, professional knowledge in the field of information technology, and patient feedback experience knowledge to optimize digital medical services.	DIC2	
	3. In the digital innovation project of the West China Hospital Medical Consortium, medical staff and technical workers are deeply involved in system development and process optimization, while actively collecting the needs and suggestions of customer groups such as patients and their families, and integrating them into digital innovation practices.	DIC3	
Digital infrastructure development, DID	1. The digital storage system of West China Hospital Alliance Hospital can efficiently store and process massive medical data, and its storage system can meet the hospital's future big data growth needs (such as unified storage of electronic medical record data, log files, medical images, etc.); Its data processing platform has powerful computing capabilities and can quickly complete big data analysis tasks to meet the business needs of patients.	DID1	Z. Y. Du and Wang (2024), N. Li (2024)
	2. The various digital information platforms of West China Hospital Alliance Hospital can achieve seamless integration of data from different sources (such as electronic medical record system, medical imaging system, experimental information system), ensuring accurate and real-time synchronization of data in the system; The data sharing interface can support data exchange with regional medical information platforms, research institution data platforms, etc., achieving the sharing of medical data on a larger scale.	DID2	
	3. West China Medical Alliance Hospital has professional data analysis tools and algorithm models, which can deeply mine medical data (such as analyzing patient disease history, treatment plans, recovery status, etc.), and effectively apply the data analysis results to	DID3	

	hospital management (such as improving service processes based on patient satisfaction data).		
	4. The West China Hospital Alliance Hospital has established a comprehensive data security management system, which strictly controls the collection, storage, transmission, and use of data. Advanced data encryption technology is used to prevent data from being tampered with during transmission and storage, and to protect patients' personal information and medical data from being leaked during data analysis and sharing.	DID4	
Medical demand satisfaction, MDS	1. The West China Hospital Medical Consortium has effectively fulfilled its promises made to patients at the beginning of its services, such as providing accurate and efficient diagnosis, personalized treatment plans, and timely allocation of medical resources.	MDS1	Cambra-Fierro and Polo-Redondo (2008)
	2. During the process of receiving medical services in the West China Hospital medical consortium, patients have a positive interaction and relationship with medical staff and service personnel at all levels of the consortium, and can feel respected, cared for, and professionally treated.	MDS2	
	3. Compared to the ideal medical service status of patients, I am satisfied with the overall situation of the West China Hospital Medical Alliance in meeting my own medical needs (including disease diagnosis and treatment, rehabilitation nursing, health guidance, etc.)	MDS3	
Peer competition pressure, PCP	1. In terms of data-driven medical services, the competitors of West China Medical Alliance Hospital have taken more extensive measures to optimize medical processes and improve service quality through data.	PCP1	Bhatia and Kumar (2022)
	2. The competitors of West China Medical Alliance Hospital are more actively investing in data-driven medical services, using data analysis to assist diagnosis and more accurate health management solutions, and have achieved more significant benefits, such as increased patient satisfaction and reduced medical costs.	PCP2	
	3. The competitors of West China Medical Alliance Hospital have achieved medical service innovation through data-driven approaches, such as providing personalized medical services and optimizing the medical experience. These hospitals have established a good reputation in the hearts of patients and are more recognized by them.	PCP3	
	4. The competitors of West China Medical Alliance Hospital, which adopts a data-driven	PCP4	

	medical service model, have significantly enhanced their competitiveness in the medical market and attracted more patients to seek medical treatment.		
Organizational Digital concern, ODC	1. The core management team of West China Hospital's medical consortium attaches great importance to knowledge and information from cutting-edge technologies in the digital healthcare field, medical data security policies, and other aspects, considering them as key elements in promoting the development of the medical consortium.	ODC1	F. Yu et al. (2021)
	2. The core management team of West China Hospital Medical Consortium often considers how to deeply integrate medical big data analysis technology, AI assisted diagnostic systems and other knowledge and information with the internal diagnosis and treatment process optimization, patient service improvement and other businesses of the medical consortium.	ODC2	
	3. The core management team of West China Hospital Medical Consortium often deeply interprets national digital healthcare development policies, industry digital transformation standards and other knowledge and information, and explores the direction and strategies suitable for the development of medical consortia from them.	ODC3	
	4. The core management team of West China Hospital Medical Consortium has invested a lot of time and energy in researching, analyzing, and following up on knowledge and information related to medical digital innovation technology and collaborative sharing models of medical consortium data.	ODC4	
Digital resources supply, DRS	1. The expenditures of West China Hospital Medical Consortium in hardware equipment procurement (such as intelligent diagnosis and treatment terminals, data center servers), software and IT service procurement (medical data analysis software, system operation and maintenance services), and telecommunications network construction (5G medical private network, data transmission dedicated line) can fully meet the digital resource supply needs of the medical consortium.	DRS1	Szopa and Cyplik (2020)
	2. The digital hardware assets (such as intelligent surgical equipment, regional inspection automation instruments) and medical professional software (electronic medical record system, remote consultation platform) reflected in the West China Hospital Medical Association can ensure the effective supply of digital resources for the medical association in terms of	DRS2	

	quantity and functionality.	
	3. The West China Hospital Medical Consortium provides each employee with digital technology equipment (mobile ward rounds, portable diagnostic devices), software and IT services (medical APP authorization, cloud storage), and telecommunications support (work flow packages, remote collaboration networks) to meet their daily digital work needs.	DRS3
	4. Compared to the previous year, the digital hardware assets (such as updated intelligent monitoring devices, new IoT terminals) and software assets (newly introduced AI diagnosis and treatment systems, upgraded patient management software) corresponding to each employee of the West China Hospital Medical Consortium have increased in value and functionality, promoting the improvement of digital resource supply capabilities.	DRS4
	5. The proportion of standardized digital workstations (integrating multiple medical systems and supporting real-time data sharing) in various medical institutions of the West China Hospital Medical Consortium can meet the work needs of the consortium for digital medical services and digital resource supply.	DRS5

3.4 Pilot test

3.4.1 Item testing and pre research

After completing the questionnaire design, further verification of the items, reliability, and structural validity was required to ensure the rigour of the data collection process and the research results. This study confirmed the questionnaire structure and item design through a pre-test and predictive data analysis. The specific steps are described below:

First, as some reference measurement scales were initially developed in English, members of the research team participated in a focused discussion to optimise the questionnaire. The author and the research team conducted multiple rounds of forward and reverse translation between Chinese and English to ensure accurate expression of vocabulary. In addition, two academic supervisors and several domain experts were invited to provide suggestions for questionnaire revisions. Based on their feedback, the author revised the items repeatedly. Common issues addressed during the revision process included the need for clearer literature support and accurate citation for variable measurement, replacement of imprecise reference items, modification of items that were inconsistent with actual hospital conditions, updating

descriptions related to digital facility construction to reflect current infrastructure developments, and modification of the scale format from a seven point scale to a five point scale to improve response accuracy.

Second, several hospital executives were invited to review the questionnaire. This stage aimed to optimise the clarity and suitability of questionnaire content for respondents and to minimise ambiguity, unclear wording, unrealistic scenarios, or excessive academic terminology that could hinder comprehension. After multiple rounds of review and revision, the questionnaire received positive agreement from participating executives.

Third, following refinement of the questionnaire, a pilot survey was conducted to test reliability and structural validity. Data collection took place between 3 June 2025 and 23 June 2025. A total of 40 questionnaires were distributed to executives of Sino-Western medicine joint hospitals, and 35 were collected and used for preliminary reliability and validity analysis.

3.4.2 Pilot test factor load analysis

Pilot survey data were entered into SPSS for factor analysis. Factor loadings greater than 0.7 indicate acceptable measurement performance. As shown in Table 3.3, the factor structures of the variables were generally consistent with the expected loading distributions. However, the loadings of PCP3 and DRS4 were 0.264 and 0.407, respectively, both below the acceptable threshold of 0.7. Other measurement items exhibited factor loadings above 0.7. These results indicate that PCP3 and DRS4 show insufficient factor loadings and may require modification or removal.

Table 3.3 Load analysis of pilot test factors

	1	2	3	4	5	6	7	note
DIC1	0.035	0.157	-0.162	0.220	0.256	-0.079	0.804	
DIC2	0.025	0.008	0.065	0.089	0.208	-0.068	0.870	
DIC3	-0.025	-0.084	-0.051	0.012	0.021	0.014	0.922	
DID1	0.230	0.850	-0.170	-0.120	-0.010	-0.015	-0.030	
DID2	-0.147	0.850	0.124	-0.057	0.009	-0.102	0.100	
DID3	0.009	0.842	-0.165	-0.049	-0.245	-0.107	0.123	
DID4	-0.116	0.901	-0.026	-0.023	0.013	-0.110	-0.250	
MDS1	-0.206	-0.081	0.189	-0.056	0.850	0.036	0.121	
MDS2	-0.189	-0.062	-0.063	-0.164	0.914	-0.041	0.129	
MDS3	-0.098	-0.016	-0.117	-0.057	0.813	0.113	0.196	
PCP1	-0.041	-0.102	0.049	0.088	-0.023	0.905	-0.080	
PCP2	-0.043	-0.201	-0.176	0.092	0.090	0.873	0.019	
PCP3	-0.209	-0.560	-0.122	0.047	-0.090	0.264	-0.094	<0.5
PCP4	-0.041	-0.137	0.033	-0.125	0.024	0.927	-0.036	
ODC1	0.139	-0.111	0.865	-0.018	-0.066	-0.003	-0.130	
ODC2	0.067	0.017	0.886	-0.222	0.027	0.021	0.067	
ODC3	0.097	-0.013	0.913	-0.088	0.053	-0.105	0.040	
ODC4	0.012	0.013	0.895	0.013	-0.049	0.010	-0.093	
DRS1	0.062	-0.032	-0.155	0.870	0.014	-0.013	0.015	
DRS2	0.007	-0.032	-0.067	0.885	-0.139	0.086	0.105	
DRS3	0.239	-0.219	0.105	0.827	0.004	0.130	0.163	
DRS4	-0.166	-0.144	0.110	0.407	-0.378	0.284	-0.029	<0.5
DRS5	-0.082	0.009	-0.220	0.820	-0.139	-0.182	0.048	
DC1	0.805	-0.015	-0.039	0.051	-0.268	0.027	-0.120	
DC2	0.874	-0.111	0.120	0.051	-0.049	-0.046	-0.094	
DC3	0.924	-0.085	0.132	0.060	0.002	-0.043	0.035	
DC4	0.862	0.002	0.101	0.008	-0.227	-0.124	-0.040	
DC5	0.858	0.200	0.022	0.112	0.140	0.000	0.160	
DC6	0.842	0.094	-0.014	0.229	0.195	0.128	0.022	
DC7	0.815	0.111	0.053	-0.228	-0.273	-0.054	-0.062	
DC8	0.816	-0.193	0.125	-0.021	-0.141	-0.051	0.043	
DC9	0.834	0.258	-0.078	-0.116	-0.031	-0.076	0.110	

3.4.3 Deviation analysis of the standard method for pilot testing

Harman's single-factor test was used to examine the presence of common method bias. When the variance explained by a single factor is less than 40%, it indicates that there is no significant standard method bias. The pilot test results of this study showed that the first factor explained 22.527% of the variation, the second factor 14.031%, and the third 12.791%, all of which were less than 40%. This indicates that the common method bias in this study was not severe.

3.4.4 Internal consistency analysis of pilot testing

Corrected item total correlation (CITC) refers to the correlation coefficient between an individual item and the total score of the remaining items within the scale, with values ranging from -1 to 1. Higher CITC values indicate stronger item correlations and greater internal consistency. When the CITC value is lower than 0.4, the corresponding item is considered to require revision or removal.

The Cronbach's alpha coefficient is a commonly used measure of internal consistency. A coefficient greater than 0.7 indicates good internal consistency.

This study used SPSS to conduct reliability analyses of the pilot survey data, evaluating item and scale internal consistency using CITC and Cronbach's alpha coefficients. Table 3.4 presents the results of the internal consistency analysis of the pilot test.

Table 3.4 Internal consistency analysis of pilot testing

Variables	Items	CITC	CITC if Item Deleted	Cronbach's α	Cronbach's α if Item Deleted	Solution
Digital innovation capability	DIC1	0.748	0.748	0.872	0.828	Pass
	DIC2	0.758	0.758		0.817	Pass
	DIC3	0.763	0.763		0.812	Pass
Digital infrastructure development	DID1	0.774	0.774	0.905	0.882	Pass
	DID2	0.784	0.784		0.878	Pass
	DID3	0.761	0.761		0.886	Pass
	DID4	0.829	0.829		0.863	Pass
Medical demand satisfaction	MDS1	0.768	0.768	0.894	0.871	Pass
	MDS2	0.900	0.900		0.753	Pass
	MDS3	0.716	0.716		0.914	Pass
Peer competition pressure	PCP1	0.733	0.836	0.813	0.713	Pass
	PCP2	0.781	0.799		0.689	Pass
	PCP3	0.306	/		0.909	Remove
	PCP4	0.792	0.847		0.703	Pass
Organizational Digital concern	ODC1	0.789	0.789	0.922	0.909	Pass
	ODC2	0.834	0.834		0.893	Pass
	ODC3	0.846	0.846		0.889	Pass
	ODC4	0.811	0.811		0.902	Pass

Digital resources supply	DRS1	0.725	0.787	0.841	0.790	Pass
	DRS2	0.813	0.832		0.761	Pass
	DRS3	0.707	0.731		0.791	Pass
	DRS4	0.349	/		0.893	Remove
	DRS5	0.702	0.714		0.793	Pass
Dynamic capability of medical services (DC)	DC1	0.776	0.776	0.953	0.949	Pass
	DC2	0.830	0.830		0.947	Pass
	DC3	0.898	0.898		0.944	Pass
	DC4	0.851	0.851		0.946	Pass
	DC5	0.820	0.820		0.947	Pass
	DC6	0.772	0.772		0.950	Pass
	DC7	0.798	0.798		0.948	Pass
	DC8	0.776	0.776		0.949	Pass
	DC9	0.796	0.796		0.948	Pass

There are three dimensions for digital innovation capability, with CITC values ranging from 0.748 to 0.763, all exceeding the acceptable threshold of 0.4. Therefore, all items were retained. The Cronbach alpha coefficient was 0.872, which is greater than 0.7. Removal of any item decreased the Cronbach alpha coefficient, indicating good internal consistency among the three items measuring digital innovation capability.

For digital infrastructure development, four dimensions were assessed, with CITC values ranging from 0.761 to 0.829, all exceeding 0.4. All items were therefore retained. The Cronbach alpha coefficient was 0.905, which is greater than 0.7. Deletion of any item reduced the Cronbach alpha coefficient, indicating good internal consistency among the four items measuring digital infrastructure development.

There are three dimensions for medical demand satisfaction, with CITC values ranging from 0.716 to 0.900, all exceeding 0.4. Therefore, all items were retained. The Cronbach alpha coefficient was 0.894, which is greater than 0.7; deleting any item did not significantly improve the coefficient. After removing MDS3, the coefficient increased to 0.914. These results indicate good internal consistency among the three items measuring medical demand satisfaction.

There are four dimensions for peer competition pressure, with CITC values ranging from 0.306 to 0.792. The CITC value for PCP3 was below 0.4; therefore, this item was recommended for removal. The remaining items all showed CITC values above 0.4 and were retained. The Cronbach alpha coefficient was 0.813, which is greater than 0.7. After deleting PCP3, the Cronbach alpha coefficient increased to 0.909. These results indicate that the measurement scale for peer competition pressure requires refinement. After revision, the retained items were as follows. PCP1 indicates that competitors in data-driven medical services have adopted more extensive measures to optimise medical processes and improve service quality. PCP2 indicates that competitors of the West China Hospital Medical Consortium invest more actively in data-driven medical services, use data analysis to support diagnosis, and provide more precise health

management solutions, achieving greater benefits, including increased patient satisfaction and reduced medical costs. PCP4 indicates that competitors adopting data-driven medical service models have significantly enhanced their competitiveness in the healthcare market and attracted more patients seeking medical treatment.

Regarding organisational digital concern, four dimensions were assessed, with CITC values ranging from 0.789 to 0.846, all exceeding the acceptable threshold of 0.4. Therefore, all items were retained. The Cronbach alpha coefficient was 0.922, which is greater than 0.7. Removal of any item decreased the Cronbach's alpha coefficient, indicating good internal consistency among the four items measuring organisational digital concern.

There are five dimensions for digital resource supply, with CITC values ranging from 0.349 to 0.813. The CITC value for DRS4 was 0.349, which is below the acceptable threshold of 0.4; therefore, this item was recommended for removal. The remaining items all demonstrated CITC values greater than 0.4 and were retained. The Cronbach alpha coefficient was 0.841, which is greater than 0.7. After deleting DRS4, the Cronbach alpha coefficient increased to 0.893, indicating improved internal consistency. Following the revision, the retained measurement items were as follows. DRS1 indicates that the West China Hospital Medical Consortium can fully meet digital resource supply demands through expenditure on hardware equipment procurement (such as intelligent diagnosis and treatment terminals, data centre servers), software and IT service procurement (medical data analysis software, system operation and maintenance services), and telecommunications network construction (5G medical private network, dedicated data transmission lines). DRS2 indicates that the digital hardware assets, including intelligent surgical equipment and regional inspection automation instruments, and professional medical software, including electronic medical record systems and remote consultation platforms, used by the West China Hospital Medical Consortium, ensure an adequate supply of digital resources in terms of quantity and functionality. The DRS3 indicates that the West China Hospital Medical Consortium provides each employee with digital technology equipment (mobile ward rounds, portable diagnostic devices), software and IT services (medical app authorisation, cloud storage), and telecommunications support (workflow packages, remote collaboration networks) to meet their daily digital work needs. DRS5 indicates that the proportion of standardised digital workstations, which integrate multiple medical systems and support real-time data sharing, across medical institutions within the West China Hospital Medical Consortium meets operational demands for digital medical services and digital resource supply.

Regarding the dynamic capability of medical services, 9 items were assessed, with CITC

values ranging from 0.772 to 0.898, all exceeding the 0.4 threshold. All items were therefore retained. The Cronbach alpha coefficient was 0.953, which is greater than 0.7. Deletion of any item decreased the Cronbach alpha coefficient. These results indicate good internal consistency among the nine items measuring the dynamic capability of medical services.

3.5 Revised scale

Based on the pilot test results, the revised scale is presented in Table 3.5. The final questionnaire developed from Table 3.5 is provided in the survey questionnaire appendix of this study.

Table 3.5 Revised scale

Variable	Measurement items	Item number	References
Digital innovation capability, DIC	1. The West China Hospital Medical Consortium has formed a cultural atmosphere that encourages digital innovation and tolerates trial and error. Regular discussions and exchanges related to digital innovation are held, and employees have a high enthusiasm for participating in digital innovation projects.	DIC1	Rajapathirana and Hui (2018)
	2. In the process of promoting digital innovation, the West China Hospital Medical Consortium fully integrates multi-source knowledge such as medical clinical data knowledge, professional knowledge in the field of information technology, and patient feedback experience knowledge to optimize digital medical services.	DIC2	
	3. In the digital innovation project of the West China Hospital Medical Consortium, medical staff and technical workers are deeply involved in system development and process optimization, while actively collecting the needs and suggestions of customer groups such as patients and their families, and integrating them into digital innovation practices.	DIC3	
Digital infrastructure development, DID	1. The digital storage system of West China Hospital Alliance Hospital can efficiently store and process massive medical data, and its storage system can meet the hospital's future big data growth needs (such as unified storage of electronic medical record data, log files, medical images, etc.); Its data processing platform has powerful computing capabilities and can quickly complete big data analysis tasks to meet the business needs of patients.	DID1	Z. Y. Du and Wang (2024) N. Li (2024)
	2. The various digital information platforms of West China Hospital Alliance Hospital can achieve seamless integration of data from different sources (such as electronic medical record system, medical imaging system, experimental information system), ensuring	DID2	

	accurate and real-time synchronization of data in the system; The data sharing interface can support data exchange with regional medical information platforms, research institution data platforms, etc., achieving the sharing of medical data on a larger scale.		
	3. West China Medical Alliance Hospital has professional data analysis tools and algorithm models, which can deeply mine medical data (such as analyzing patient disease history, treatment plans, recovery status, etc.), and effectively apply the data analysis results to hospital management (such as improving service processes based on patient satisfaction data).	DID3	
	4. The West China Hospital Alliance Hospital has established a comprehensive data security management system, which strictly controls the collection, storage, transmission, and use of data. Advanced data encryption technology is used to prevent data from being tampered with during transmission and storage, and to protect patients' personal information and medical data from being leaked during data analysis and sharing.	DID4	
	1The West China Hospital Medical Consortium has effectively fulfilled its promises made to patients at the beginning of its services, such as providing accurate and efficient diagnosis, personalized treatment plans, and timely allocation of medical resources.	MDS1	
Medical demand satisfaction, MDS	2. During the process of receiving medical services in the West China Hospital medical consortium, patients have a positive interaction and relationship with medical staff and service personnel at all levels of the consortium, and can feel respected, cared for, and professionally treated.	MDS2	Cambra-Fierro and Polo-Redondo (2008)
	3. Compared to the ideal medical service status of patients, I am satisfied with the overall situation of the West China Hospital Medical Alliance in meeting my own medical needs (including disease diagnosis and treatment, rehabilitation nursing, health guidance, etc.).	MDS3	
	1. In terms of data-driven medical services, the competitors of West China Medical Alliance Hospital have taken more extensive measures to optimize medical processes and improve service quality through data.	PCP1	
Peer competition pressure, PCP	2. The competitors of West China Medical Alliance Hospital are more actively investing in data-driven medical services, using data analysis to assist diagnosis and more accurate health management solutions, and have achieved more significant benefits, such as increased patient satisfaction and reduced medical costs.	PCP2	Bhatia and Kumar (2022)
	3. The competitors of West China Medical	PCP3	

	Alliance Hospital, which adopts a data-driven medical service model, have significantly enhanced their competitiveness in the medical market and attracted more patients to seek medical treatment.		
Organizational Digital concern, ODC	1. The core management team of West China Hospital's medical consortium attaches great importance to knowledge and information from cutting-edge technologies in the digital healthcare field, medical data security policies, and other aspects, considering them as key elements in promoting the development of the medical consortium.	ODC1	F. Yu et al. (2021)
	2. The core management team of West China Hospital Medical Consortium often considers how to deeply integrate medical big data analysis technology, AI assisted diagnostic systems and other knowledge and information with the internal diagnosis and treatment process optimization, patient service improvement and other businesses of the medical consortium.	ODC2	
	3. The core management team of West China Hospital Medical Consortium often deeply interprets national digital healthcare development policies, industry digital transformation standards and other knowledge and information, and explores the direction and strategies suitable for the development of medical consortia from them.	ODC3	
	4. The core management team of West China Hospital Medical Consortium has invested a lot of time and energy in researching, analyzing, and following up on knowledge and information related to medical digital innovation technology and collaborative sharing models of medical consortium data.	ODC4	
Digital resources supply, DRS	1. The expenditures of West China Hospital Medical Consortium in hardware equipment procurement (such as intelligent diagnosis and treatment terminals, data center servers), software and IT service procurement (medical data analysis software, system operation and maintenance services), and telecommunications network construction (5G medical private network, data transmission dedicated line) can fully meet the digital resource supply needs of the medical consortium.	DRS1	Szopa and Cyplik (2020)
	2. The digital hardware assets (such as intelligent surgical equipment, regional inspection automation instruments) and medical professional software (electronic medical record system, remote consultation platform) reflected in the West China Hospital Medical Association can ensure the effective supply of digital resources for the medical association in terms of quantity and functionality.	DRS2	

	3. The West China Hospital Medical Consortium provides each employee with digital technology equipment (mobile ward rounds, portable diagnostic devices), software and IT services (medical APP authorization, cloud storage), and telecommunications support (work flow packages, remote collaboration networks) to meet their daily digital work needs.	DRS3	
	4. The proportion of standardized digital workstations (integrating multiple medical systems and supporting real-time data sharing) in various medical institutions of the West China Hospital Medical Consortium can meet the work needs of the consortium for digital medical services and digital resource supply.	DRS4	
Dynamic capability of medical services, DC	1. The proportion of cross functional teams formed by hospitals that include professionals from multiple fields such as clinical medicine, information technology, and patient experience management to the planned number of teams.	DC1	Scuotto et al. (2024)
	2. The proportion of actual work time invested by cross functional team members in the development process of medical service products to the total project development time.	DC2	
	3. The proportion of new diagnosis and treatment solutions, digital medical service platforms, and other medical service products developed and put into use by cross functional teams to the total number of projects undertaken by the team.	DC3	
	4. The actual amount of resources obtained by the hospital in terms of medical equipment procurement, research funding investment, and allocation of training resources for medical staff has reached the planned amount.	DC4	
	5. The allocation ratio of medical resources among different innovative projects and the matching degree of project requirements.	DC5	
	6. The ratio of medical resources invested to the output of innovative projects	DC6	
	7. The number of strategic alliances newly established by hospitals with other medical institutions, research institutes, technology enterprises, etc., and the growth rate compared to the previous period.	DC7	
	8. The proportion of successful promotion and application of new medical service products (such as new diagnostic technologies, remote medical services, etc.) developed by hospitals in cooperation with external strategic alliances to new patient groups or medical market fields, compared to the total number of joint research and development achievements.	DC8	
	9. The contribution of advanced medical technology, scientific research achievements, professional talents and other resources	DC9	

	introduced by hospitals through strategic alliances to the development of medical service innovation projects and the improvement of medical service quality.

3.5 Data collection and sample characteristics

Following the pilot testing phase, the final questionnaire was developed and distributed. From 1 July 2025 to 20 July 2025, 130 questionnaires were distributed to executives of Chinese Western medicine joint hospitals. A total of 116 questionnaires were returned, while 14 questionnaires were not collected. Due to built-in error-prevention measures, all returned questionnaires were valid, resulting in an effective response rate of 89.23%.

The sample characteristics are presented in Table 3.6.

Table 3.6 Sample feature information

Category	Item	Quantity	Proportion
Gender	Female	30	25.86%
	Male	86	74.14%
Respondent age	18-30	12	10.34%
	31-35	50	43.10%
	46-60	26	22.41%
	61 and above	28	24.14%
EDU	Junior college degree or below	9	7.76%
	Bachelor degree	39	33.62%
	Master degree or above	68	58.62%
Hospital type	Core Hospital (West China Hospital Headquarters)	35	30.17%
	Member units of closely knit medical consortia (municipal hospitals)	36	31.03%
	Grassroots member units of medical consortia (county-level hospitals+ community health service centers)	21	18.10%
	Other relevant cooperative institutions	24	20.69%
Location GDP	less than average	31	26.72%
	Middle	62	53.45%
	More than average	23	19.83%
Employee	<100	28	24.14%
	100-500	21	18.10%
	501-1000	31	26.72%
	1001-2000	24	20.69%
	>2000	12	10.34%
Hospital age	<5 years	13	11.21%
	5-10 years	11	9.48%
	11-20 years	39	33.62%
	>20 years	53	45.69%
R&D intensity	<3%	9	7.76%
	3%-5% (exclude 5%)	26	22.41%
	5%-10% (exclude 10%)	43	37.07%
	10%-20% (exclude 20%)	28	24.14%

20% and above	10	8.62%

3.6 Chapter summary

This chapter applied fsQCA as the primary research method and explained the rationale for selecting the medical consortium hospitals of West China Hospital as the research objects. It measured the key study variables, including the dynamic capability of medical services, digital innovation capability, digital infrastructure development, medical demand satisfaction, peer competition pressure, organisational digital concern, and digital resource supply. Pilot testing of the measurement scales was conducted, and necessary revisions were made. In addition, the data collection procedures and detailed sample characteristics were described.

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Chapter 4: Configuration Analysis of the Dynamic Capability of Medical Services in West China Hospital Alliance

The previous chapter presented the methodology, the selection of the research object, the measurement of variables, pilot testing, data collection, and the sample characteristics of this study. This chapter reports the assessment of data reliability and validity, tests for common method bias, data calibration and descriptive statistical analysis, necessary condition analysis, fsQCA configuration analysis, identification of antecedent condition configurations associated with high dynamic capability of medical services, and robustness testing.

4.1 Reliability and validity

To confirm the reliability and validity of the final scale and survey data, this study organised the formal survey responses and calculated factor loadings, Cronbach alpha values, composite reliability values, and average variance extracted values for each variable. Factor loading reflects the correlation between observed variables and latent constructs and indicates the degree to which each observed indicator contributes to the underlying factors. Cronbach's alpha is the most widely used reliability indicator for assessing internal consistency of questionnaires and scales, with values ranging from 0 to 1. Higher values indicate stronger internal consistency, with 0.7 commonly accepted as the threshold criterion. Composite reliability is a key indicator of internal consistency and construct reliability that quantifies the correlations among indicators; values greater than 0.7 are recommended. Average variance extracted measures the average proportion of variance shared between constructs and their observed indicators and is used to assess convergent and discriminant validity of measurement models. Values greater than 0.5 are recommended. The calculations show that factor loadings for all variables exceed 0.7, Cronbach alpha values exceed 0.7, composite reliability values exceed 0.7, and average variance extracted values exceed 0.5. As shown in Table 4.1, these results indicate that the questionnaire and data demonstrate good reliability and validity.

Table 4.1 Reliability and validity

Variables	Items	Factor load	Cronbach's α	CR	AVE
Digital innovation capability	DIC1	0.831	0.788	0.877	0.704
	DIC2	0.795			
	DIC3	0.888			
Digital infrastructure development	DID1	0.869	0.852	0.901	0.695
	DID2	0.799			
	DID3	0.836			
	DID4	0.829			
Medical demand satisfaction	MDS1	0.868	0.862	0.912	0.784
	MDS2	0.895			
	MDS3	0.893			
Peer competition pressure	PCP1	0.897	0.839	0.904	0.758
	PCP2	0.842			
	PCP3	0.872			
Organizational Digital concern	ODC1	0.901	0.919	0.943	0.805
	ODC2	0.896			
	ODC3	0.886			
	ODC4	0.906			
Digital resources supply	DRS1	0.908	0.928	0.951	0.830
	DRS2	0.913			
	DRS3	0.891			
	DRS4	0.931			
Dynamic capability of medical services (DC)	DC1	0.854	0.948	0.956	0.708
	DC2	0.840			
	DC3	0.873			
	DC4	0.852			
	DC5	0.826			
	DC6	0.832			
	DC7	0.823			
	DC8	0.830			
	DC9	0.843			

4.2 Common method deviation

Harman's single-factor test was used to examine common method bias. When the variance explained by a single factor is less than 40%, common method bias is considered insignificant. The results showed that the first factor explained 29.500% of the variance, the second factor 12.676%, and the third 9.491%. All values were below the 40 per cent threshold, indicating that common method bias in this study is not severe.

4.3 Data calibration and descriptive statistical analysis

Data organisation was required before conducting configuration analysis. Table 4.2 presents the calibration and descriptive statistical analysis. The findings indicate that, based on the five-point Likert scale questionnaire, the minimum value for each variable was 1 and the maximum

was 5. The mean values ranged from 2.931 to 3.239, while the standard deviation ranged from 1.176 to 1.442. For data calibration, SPSS software was used to calculate quartiles. Complete membership, crossover points, and complete nonmembership were set at the 25%, 50%, and 75% thresholds of each variable's distribution, respectively.

Table 4.2 Calibration and descriptive statistics

	Calibration anchor point			Descriptive analysis			
Gather	Completely not affiliated 25%	Intersection50%	Fully subordinate 75%	Minimum	Maximum	Mean	Standard deviation
DIC	2.000	2.834	4.000	1.00	5.00	2.983	1.212
DID	2.063	2.750	4.188	1.00	5.00	2.931	1.176
MDS	2.000	3.000	4.667	1.00	5.00	3.195	1.331
PCP	2.333	3.000	4.250	1.00	5.00	3.103	1.215
ODC	1.563	3.375	4.500	1.00	5.00	3.159	1.442
DRS	1.813	3.250	4.500	1.00	5.00	3.239	1.347
DC	2.000	3.556	4.444	1.00	5.00	3.213	1.308

4.4 Analysis of necessity conditions

Before conducting configuration analysis, a necessity condition analysis was performed to examine whether any single antecedent variable had a significant impact on the overall outcome. This study conducted a necessity condition analysis using calibrated data, with DC as the dependent variable and DIC, DID, MDS, PCP, ODC, DRS, as well as ~DIC, ~DID, ~MDS, ~PCP, ~ODC, ~DRS as independent variables. The results of the analysis are presented in Table 4.3.

Table 4.3 Results of necessity condition analysis

Gather	High dynamic capability of medical services	
	Consistency	Coverage
FDIC	0.624	0.630
~FDIC	0.460	0.440
FDID	0.682	0.660
~FDIC	0.460	0.440
FMDS	0.650	0.665
~FMDS	0.450	0.425
FPCP	0.590	0.583
~FPCP	0.498	0.486
FODC	0.674	0.687
~FODC	0.421	0.399
FDRS	0.639	0.663
~FDRS	0.462	0.431

The findings in Table 4.3 indicate that the consistency values of all antecedent variables are below 0.9. This demonstrates that no single condition is sufficient to produce high dynamic capabilities in medical services.

4.5 FsQCA configuration analysis

4.5.1 FsQCA parameter settings

Configuration analysis was conducted using the calibrated data, with DC as the dependent variable and DIC, DID, MDS, PCP, ODC, and DRS as independent variables. The consistency threshold was set at 0.8, the case frequency cut-off at 2, and the PRI consistency threshold at 0.7. Based on these parameter settings, the fsQCA software was used for analysis, and the results are presented in Table 4.4.

Table 4.4 Configuration analysis results of high dynamic capability of medical services

Conditional configuration	High dynamic capability of medical services								
	MDS*ODC*DRS	DID*MDS*PCP		DIC*DID*MDS		PCP*ODC			
	Path 1	Path 2	Path 3	Path 4	Path 5	Path 6	Path 7	Path 8	Path 9
DIC	⊗	•	⊗	●	●	•	•	•	
DID	⊗	●	●	●	●	•	•		•
MDS	●	●	●	●	●	⊗		⊗	⊗
PCP		●	●		⊗	●	●	●	●
ODC	●		⊗	•	⊗	●	●	●	●
DRS	●	⊗	•	⊗	•		⊗	•	•
Raw coverage	0.148	0.150	0.091	0.160	0.102	0.178	0.161	0.168	0.184
Unique coverage	0.076	0.035	0.031	0.044	0.053	0.000	0.000	0.032	0.039
Consistency	0.866	0.941	0.947	0.966	0.945	0.939	0.924	0.931	0.933
Solution coverage				0.573					
Solution consistency				0.908					

Note: ●(large) indicates the existence of core conditions; ●(Small) indicates the existence of edge conditions; ⊗ indicates the absence of edge conditions. 'Space' indicates that conditions can exist or be missing.

In Table 4.4, fs denotes fuzzy set qualitative comparative analysis, and the symbol ~ indicates the absence of a condition.

The results show four core solution paths leading to high dynamic capability of medical services: MDS * ODC * DRS, DID * MDS * PCP, DIC * DID * MDS, PCP * ODC. A total of nine intermediate solution configurations were identified as follows: (1) ~fsDIC *~fsDID * fsMDS * fsODC * fsDRS; (2) fsDIC * fsDID * fsMDS * fsPCP * ~fsDRS; (3) ~fsDIC * fsDID * fsMDS * fsPCP * ~fsODC * fsDRS; (4) fsDIC * fsDID * fsMDS * fsODC * ~fsDRS; (5) fsDIC * fsDID * fsMDS * ~fsPCP * ~fsODC * fsDRS; (6) fsDIC * fsDID * ~fsMDS * fsPCP * fsODC； (7) fsDIC * fsDID * fsPCP * fsODC * ~fsDRS; (8) fsDIC * ~fsMDS * fsPCP * fsODC * fsDRS; (9) FsDID *~fsMDS * fsPCP * fsODC * fsDRS. The overall solution coverage was 0.573, and the overall solution consistency was 0.908, indicating that the identified solution set covers most of the observed cases.

Based on the distribution of core and peripheral solution sets, the configurations were analysed as follows.

(1) In the configuration of~fsDIC *~fsDID * fsMDS * fsODC * fsDRS, MDS, ODC, and DRS are the core conditions, while DIC and DID are the missing edge conditions; (2) In configuring fsDIC * fsDID * fsMDS * fsPCP *~fsDRS, DID, MDS, and PCP are the core conditions, DIC is the edge condition, and~fsDRS is the missing edge condition; (3) In the configuration of~fsDIC * fsDID * fsMDS * fsPCP *~fsODC * fsDRS, DID, MDS, and PCP are the core conditions, DRS is the edge condition, and~fsDIC and~fsODC are the missing edge conditions; (4) In configuring fsDIC * fsDID * fsMDS * fsODC *~fsDRS, DIC, DID, and MDS are the core conditions, ODC is the edge condition, and~fsDRS is the missing edge condition; (5) In configuring fsDIC * fsDID * fsMDS *~fsPCP *~fsODC * fsDRS, DIC, DID, and MDS are the core conditions, and~fsPCP,~fsODC, and fsDRS are the edge conditions missing; (6) In configuring fsDIC * fsDID *~fsMDS * fsPCP * fsODC, PCP and ODC are the core conditions, DIC and DID are the edge conditions, and fsMDS is the missing edge condition; (7) In configuring fsDIC * fsDID * fsPCP * fsODC *~fsDRS, PCP and ODC are the core conditions, DIC and DID are the edge conditions, and~fsDRS is the missing edge condition; (8) In configuring fsDIC *~fsMDS * fsPCP * fsODC * fsDRS, PCP and ODC are the core conditions, DIC and DRS are the edge conditions, and~fsMDS is the missing edge condition; (9) In configuring fsDID *~fsMDS * fsPCP * fsODC * fsDRS, PCP and ODC are the core conditions, DID and DRS are the edge conditions, and~fsMDS is the missing edge condition.

4.5.2 Antecedent condition configurations of high dynamic capability of medical services

Further synthesis identified four main configurations associated with high dynamic capability of medical services.

Configuration 1: Resource satisfaction type. This configuration focuses primarily on meeting medical service demand through strong managerial attention and resource matching. Evidence is provided by the configuration composed of the core conditions MDS * ODC * DRS corresponding to the path ~ fsDIC * ~fsDID * fsMDS * fsODC * fsDRS (Path 1). In this pathway, medical demand satisfaction, organisational digital concern, and digital resource supply act as core conditions, while digital innovation capability and digital infrastructure development are absent as peripheral conditions. Under this configuration, high dynamic capability of medical services is achieved.

Configuration 2: Competition-driven type. This configuration emphasises response to external demand and peer competition pressure through improvements in relevant infrastructure. In the configuration composed of the core conditions DID * MDS * PCP, two paths were identified: fsDIC * fsDID * fsMDS * fsPCP *~fsDRS (Path 2) and~fsDIC * fsDID * fsMDS * fsPCP *~fsODC * fsDRS (Path 3). In Path 2, digital infrastructure development, medical demand satisfaction, and peer competition pressure serve as core conditions, while digital innovation capability is a peripheral condition. Digital resource supply is absent as a peripheral condition. Under this configuration, high dynamic capability of medical services can be achieved. In Path 3, digital infrastructure development, medical demand satisfaction, and peer competition pressure remain the core conditions, while digital innovation capability and organisational digital concern are peripheral conditions. Digital resource supply is absent as a peripheral condition. This configuration also leads to high dynamic capability of medical services.

Configuration 3: Innovation-driven type. This configuration emphasises meeting medical needs through combined digital innovation capability and digital infrastructure development. Within the configuration composed of the core conditions DIC * DID * MDS, two paths were identified: fsDIC * fsDID * fsMDS * fsODC *~fsDRS (Path 4) and fsDIC * fsDID * fsMDS *~fsPCP *~fsODC * fsDRS (Path 5). In Path 4, digital innovation capability, digital infrastructure development, and medical demand satisfaction act as core conditions, while organisational digital concern is a peripheral condition. Digital resource supply is absent as a peripheral condition. This configuration enables high dynamic capability of medical services. In Path 5, digital innovation capability, digital infrastructure development, and medical demand

satisfaction remain core conditions, while digital resource supply acts as a peripheral condition. Peer competition pressure and organisational digital concern are absent as peripheral conditions. This path likewise supports high dynamic capability of medical services.

Configuration 4: Internal and External Dual-Driven Type. This configuration is driven jointly by external competitive pressure and internal managerial attention. Within the configuration composed of the core conditions PCP*ODC, four paths were identified. Among these, Paths 6 and 7 display relatively low coverage: fsDIC * fsDID * ~fsMDS * fsPCP * fsODC (Path 6)； fsDIC * fsDID * fsPCP * fsODC * ~fsDRS (Path 7). The remaining paths are fsDIC * ~fsMDS * fsPCP * fsODC * fsDRS (Path 8) and fsDID * ~fsMDS * fsPCP * fsODC * fsDRS (Path 9). In Path 6, peer competition pressure and organisational digital concern function as core conditions, while digital innovation capability and digital infrastructure development act as peripheral conditions. Medical demand satisfaction is absent as a peripheral condition. This configuration achieves high dynamic capability of medical services. In Path 7, peer competition pressure and organisational digital concern again serve as core conditions, with digital innovation capability and digital infrastructure development acting as peripheral conditions, while digital resource supply is absent as a peripheral condition. This configuration also results in high dynamic capability of medical services. In Path 8, peer competition pressure and organisational digital concern remain core conditions. Digital innovation capability and digital resource supply are peripheral conditions, whereas medical demand satisfaction is not. High dynamic capability of medical services can be achieved under this configuration. In Path 9, peer competition pressure and organisational digital concern serve as core conditions, while digital infrastructure development and digital resource supply act as peripheral conditions, and medical demand satisfaction is absent as a peripheral condition. This configuration likewise leads to high dynamic capability of medical services.

4.5.3 Summary of results

Summarize the configuration path of high medical service dynamic capability and obtain Table 4.5.

Table 4.5 Configuration analysis results of high dynamic capability of medical services

Configuration type	feature	FsQCA evidence
Resource satisfaction type	Managers attach great importance to and match corresponding resources with the goal of meeting demand	(1) ~fsDIC * ~fsDID * fsMDS * fsODC * fsDRS
Competition	To cope with external	(2) fsDIC * fsDID * fsMDS * fsPCP * ~fsDRS

driven type	demand and peer competition pressure, improve infrastructure	(3) ~fsDIC * fsDID * fsMDS * fsPCP * ~fsODC * fsDRS
Innovation driven type	Strive from both digital innovation capability and digital infrastructure to meet medical needs	(4) fsDIC * fsDID * fsMDS * fsODC * ~fsDRS (5) fsDIC * fsDID * fsMDS * ~fsPCP * ~fsODC * fsDRS
Internal external dual drive type	Dual drivers of external competitive pressure and internal management attention	(6) fsDIC * fsDID * ~fsMDS * fsPCP * fsODC (7) fsDIC * fsDID * fsPCP * fsODC * ~fsDRS (8) fsDIC * ~fsMDS * fsPCP * fsODC * fsDRS (9) fsDID * ~fsMDS * fsPCP * fsODC * fsDRS

4.6 Robustness test

4.6.1 Adjustment of calibration anchor points

This study conducted robustness tests by adjusting calibration anchor points, consistency thresholds, and frequency cut-offs, and by setting different PRI consistency thresholds in the fsQCA analysis.

The calibration anchor points in the fsQCA analysis were adjusted from 52%, 50%, 75% to 10% (completely non-subordinate), 50% (intersection), 90% (completely subordinate). The frequency cutoff was set to 2, and the consistency threshold to 0.7, resulting in the output shown in Table 4.6. The results indicate that, following adjustment of the calibration anchors, four core solutions remained, namely MDS * ODC * DRS, DID * MDS * PCP, DIC * DID * MDS, and PCP * ODC. Nine specific configuration paths were identified, among which Paths 6 and 7 exhibited relatively low unique coverage. These results are essentially consistent with those obtained before adjustment.

Table 4.6 Robustness test results following calibration anchor adjustment

Conditional configuration	High dynamic capability of medical services								
	MDS*ODC*DRS	DID*MDS*PCP		DIC*DID*MDS		PCP*ODC			
	Path 1	Path 2	Path 3	Path 4	Path 5	Path 6	Path 7	Path 8	Path 9
DIC	⊗	•	⊗	●	●	•	•	•	
DID	⊗	●	●	●	●	•	•		•
MDS	●	●	●	●	●	⊗		⊗	⊗
PCP		●	●		⊗	●	●	●	●
ODC	●		⊗	•	⊗	●	●	●	●
DRS	●	⊗	•	⊗	•		⊗	•	•
Raw coverage	0.214	0.212	0.146	0.221	0.169	0.247	0.232	0.234	0.247
Unique coverage	0.067	0.031	0.027	0.038	0.047	0.000	0.000	0.029	0.036
Consistency	0.907	0.954	0.956	0.966	0.947	0.942	0.937	0.945	0.946
Solution coverage				0.607					
Solution consistency				0.909					

Note: ●(large) indicates the existence of core conditions; ●(Small) indicates the existence of edge conditions； ⊗indicates the absence of edge conditions; 'Space' indicates that conditions can exist or be missing.

4.6.2 Adjust consistency threshold

The original consistency threshold was reduced from 0.8 to 0.75 while maintaining the frequency cutoff at 2, leading to the results shown in Table 4.7. The findings indicate that four core solutions and nine configuration paths remained, with Paths 6 and 7 still showing lower unique coverage and no substantive change from the previous results.

Table 4.7 Robustness test results following adjustment of the frequency cutoff to 1

Conditional configuration	High dynamic capability of medical services								
	MDS*ODC*DRS	DID*MDS*PCP		DIC*DID*MDS		PCP*ODC			
	Path 1	Path 2	Path 3	Path 4	Path 5	Path 6	Path 7	Path 8	Path 9
DIC	⊗	•	⊗	●	●	•	•	•	
DID	⊗	●	●	●	●	•	•		•
MDS	●	●	●	●	●	⊗		⊗	⊗
PCP		●	●		⊗	●	●	●	●
ODC	●		⊗	•	⊗	●	●	●	●
DRS	●	⊗	•	⊗	•		⊗	•	•
Raw coverage	0.148	0.150	0.091	0.160	0.102	0.178	0.161	0.168	0.184
Unique coverage	0.076	0.035	0.031	0.044	0.053	0.000	0.000	0.032	0.039
Consistency	0.866	0.941	0.947	0.966	0.945	0.939	0.924	0.931	0.933
Solution coverage				0.573					
Solution consistency				0.908					

Note: ●(large) indicates the existence of core conditions; ●(Small) indicates the existence of edge conditions； ⊗ indicates the absence of edge conditions; 'Space' indicates that conditions can exist or be missing.

4.6.3 Adjusted frequency cutoff

Third, the frequency cutoff was reduced from 2 to 1 while maintaining the consistency threshold at 0.8, resulting in the results presented in Table 4.8. Under this adjustment, 6 core solutions and 9 configuration paths were identified. Paths 6 and 7 continued to display relatively low unique coverage. After excluding these two paths, the remaining configuration patterns matched the original results.

Table 4.8 Robustness test results following adjustment of the frequency cutoff to 1

Conditional configuration	High dynamic capability of medical services								
	Path 1	Path 2	Path 3	Path 4	Path 5	Path 6	Path 7	Path 8	Path 9
DIC	⊗	•	⊗	●	●		•	●	
DID	⊗	●	●	●	●	⊗			●
MDS	●	●	●		●	●	●	⊗	⊗
PCP		●	●		⊗	⊗	⊗	●	●
ODC	●		⊗	●		●	●	●	●
DRS	●	⊗	•	⊗	•	●	●	•	●
Raw coverage	0.148	0.150	0.091	0.237	0.126	0.132	0.105	0.168	0.184
Unique coverage	0.016	0.035	0.031	0.109	0.049	0.003	0.000	0.028	0.039
Consistency	0.866	0.941	0.947	0.919	0.944	0.867	0.960	0.931	0.933
Solution coverage					0.626				
Solution consistency					0.096				

Note: ●(large) indicates the existence of core conditions;●(Small) indicates the existence of edge conditions; ⊗ indicating the absence of edge conditions; ⊗ indicates that the core condition is missing. ‘Space’ indicates whether it can exist or be missing.

4.6.4 Adjustment of PRI consistency threshold

Fourth, the PRI threshold was reduced from 0.7 to 0.65 while maintaining the frequency cutoff at 2 and the consistency threshold at 0.8. The corresponding results are shown in Table 4.9. The analysis again produced four core solutions and nine configuration paths, with Paths 6 and 7 exhibiting lower unique coverage and no substantive change from the prior results.

Table 4.9 Configuration analysis results of high dynamic capability of medical services using an adjusted PRI consistency threshold of 0.65

Conditional configuration	High dynamic capability of medical services								
	MDS*ODC*DRS	DID*MDS*PCP		DIC*DID*MDS		PCP*ODC			
	Path 1	Path 2	Path 3	Path 4	Path 5	Path 6	Path 7	Path 8	Path 9
DIC	⊗	•	⊗	●	●	•	•	•	
DID	⊗	●	●	●	●	•	•		•
MDS	●	●	●	●	●	⊗		⊗	⊗
PCP		●	●		⊗	●	●	●	●
ODC	●		⊗	•	⊗	●	●	●	●
DRS	●	⊗	•	⊗	•		⊗	•	•
Raw coverage	0.148	0.150	0.091	0.160	0.102	0.178	0.161	0.168	0.184
Unique coverage	0.076	0.035	0.031	0.044	0.053	0.000	0.000	0.032	0.039
Consistency	0.866	0.941	0.947	0.966	0.945	0.939	0.924	0.931	0.933
Solution coverage				0.573					
Solution consistency				0.908					

Note: ●(large) indicates the existence of core conditions; ●(Small) indicates the existence of edge conditions; ⊗indicates the absence of edge conditions; 'Space' indicates that conditions can exist or be missing.

4.7 Chapter summary

Within a data-driven context, effective configuration and coordination of digital innovation capability, digital infrastructure development, organisational digital concern, digital resource supply, medical demand satisfaction, and responses to peer competition pressure are key to the digital innovation and digital transformation of West China Hospital Alliance hospitals, as well as to the rapid enhancement of dynamic capabilities of medical services. This study conducted configurational analysis based on survey data collected from 116 Chinese Western medicine joint hospitals. Guided by the overall TOE framework, the study examined the combined effects of six antecedent conditions influencing the dynamic capability of medical services, including technological factors (digital innovation capability, digital facility construction), organisational factors (organisational digital attention, digital resource supply), and environmental factors (medical demand satisfaction, peer competition pressure). Four configuration types that lead to high dynamic capabilities in medical services were identified.

The main findings are summarised as follows:

First, none of the six antecedent conditions alone constitutes a necessary condition for achieving high dynamic capability of medical services.

Second, four key configuration types associated with high dynamic capability in medical services at West China Medical Alliance hospitals were identified: resource-satisfaction type, competition-driven type, innovation-driven type, and internal- and external-dual-driven type.

Third, analysis across the four configurations shows that each pathway is oriented either towards satisfying medical demand or responding to competitive pressure from peers. This indicates that medical demand satisfaction and peer competition pressure are the primary external drivers of the dynamic capabilities of medical services in West China Hospital Alliance hospitals. On the one hand, higher medical demand creates development opportunities that stimulate improvements in dynamic capability. On the other hand, increased peer competition pressure encourages hospitals to optimise further and strengthen their service dynamic capabilities.

Fourth, the study demonstrates that within a digital context, factors including enhancing digital innovation capability, strengthening organisational digital focus, improving digital resource supply, and increased investment in digital infrastructure also play important roles in driving improvements in the dynamic capability of medical services.

Chapter 5: Strategies for Enhancing the Dynamic Capabilities of Medical Services in West China Hospital Alliance

5.1 Summary of configuration pathways

Based on the results of the previous chapter, this study further summarises the four main configurations associated with high dynamic capability of medical services, as presented in Table 5.1.

Table 5.1 Configuration analysis results of high dynamic capability of medical services

Configuration type	Feature	FsQCA evidence
Source satisfaction type	With the goal of meeting demand, managers attach great importance to and match corresponding resources	(1) ~fsDIC * ~fsDID * fsMDS * fsODC * fsDRS
Competition driven type	To cope with external demand and peer competition pressure, improve infrastructure	(2) fsDIC * fsDID * fsMDS * fsPCP * ~fsDRS (3) ~fsDIC * fsDID * fsMDS * fsPCP * ~fsODC * fsDRS
Innovation driven type	Strive to meet medical needs from both digital innovation capabilities and digital infrastructure	(4) fsDIC * fsDID * fsMDS * fsODC * ~fsDRS (5) fsDIC * fsDID * fsMDS * ~fsPCP * ~fsODC * fsDRS
Internal-External Dual-Driven Type	External competitive pressure and internal management focus are dual drivers	(6) fsDIC * fsDID * ~fsMDS * fsPCP * fsODC (7) fsDIC * fsDID * fsPCP * fsODC * ~fsDRS (8) fsDIC * ~fsMDS * fsPCP * fsODC * fsDRS (9) fsDID * ~fsMDS * fsPCP * fsODC * fsDRS

5.1.1 Configuration and case examples of the resource satisfaction type

Configuration 1: Resource satisfaction type. This configuration focuses primarily on satisfying medical service demand, with strong managerial attention directed towards matching and allocating appropriate resources. Evidence for this configuration is provided by the solution path composed of the core conditions MDS * ODC * DRS, corresponding to the configuration ~ fsDIC * ~fsDID * fsMDS * fsODC * fsDRS (Path 1). Within this pathway, medical demand satisfaction, organisational digital concern, and digital resource supply function as core

conditions, while digital innovation capability and digital infrastructure development are absent as peripheral conditions. Under this configuration, high dynamic capability of medical services is achieved.

Examples of hospitals that fit the resource satisfaction type include the People's Hospital of Anzhou District in Mianyang City, the People's Hospital of Anyue County, and the People's Hospital of Fushun County. Taking the People's Hospital of Anzhou District in Mianyang City as an example, the hospital was founded in 1946 and is a national tertiary comprehensive hospital integrating medical services, education, and research. It also serves as a regional medical sub-centre of Mianyang City and is a member hospital of the West China Hospital Medical Consortium. Since 2020, this hospital has focused on digitally driven transformation and development, with medical demand satisfaction, organisational digital concerns, and digital resource supply as the core conditions for improving the dynamic capability of medical services. In terms of medical demand satisfaction, the hospital provides comprehensive diagnosis and treatment services, including disease treatment, rehabilitation nursing, and health guidance. The hospital has strengthened technical cooperation with other medical consortium units to develop personalised diagnosis and treatment plans for patients. Organisational digital concern: senior management places strong emphasis on digital technology development, including the implementation of smart healthcare management centre projects and remote electrocardiogram initiatives. Regarding digital resource supply, the hospital has introduced advanced equipment, including a digital subtraction angiography system and 3D tomographic digital breast machines. Through the combination of medical demand satisfaction, organisational digital concerns, and digital resources supply measures, high dynamic capabilities of medical services have been achieved.

5.1.2 Configuration and case examples of the competition-driven type

Configuration 2: Competition-driven type. This configuration focuses on responding to external demand and peer competition pressure by improving related infrastructure. Evidence for this configuration is identified within the core condition combination DID * MDS * PCP, for which two solution paths were obtained: fsDIC * fsDID * fsMDS * fsPCP *~fsDRS (Path 2) and~fsDIC * fsDID * fsMDS * fsPCP *~fsODC * fsDRS (Path 3). In Path 2, digital infrastructure development, medical demand satisfaction, and peer competition pressure serve as core conditions, while digital innovation capability acts as a peripheral condition. Digital resource supply is absent as a peripheral condition. Under this configuration, high dynamic capability of medical services can be achieved. In Path 3, digital infrastructure development,

medical demand satisfaction, and peer competition pressure continue to function as core conditions. Digital innovation capability and organisational digital concern perform peripheral roles, while digital resource supply remains absent as a peripheral condition. This configuration similarly results in high dynamic capability of medical services.

Examples of hospitals characterised by the competition-driven type include Guanghan People's Hospital, Gulin County People's Hospital, and the Affiliated Hospital of Hainan Medical University. Taking Guanghan People's Hospital as an example, the hospital is located in Guanghan City and was founded in 1929. It is a national tertiary comprehensive hospital and has received multiple designations, including baby-friendly hospital, national chest pain centre, stroke centre, hypertension standard centre, and heart failure centre. It is also recognised as a five-star smart hospital in Sichuan Province, a provincial civilised unit, and a member hospital of the West China Hospital Medical Consortium, which has faced development pressure from increasing competition and has responded by strengthening its digital infrastructure and improving patient satisfaction. To enhance its competitive advantage, Guanghan People's Hospital accepted trusteeship from Sichuan Provincial People's Hospital and adopted the additional designation Guanghan Hospital of Sichuan Provincial People's Hospital Medical Group. Through this process, the hospital has developed into a comprehensive medical institution with complete clinical disciplines, advanced medical technology, up-to-date diagnostic and treatment equipment, and strong research capacity. Regarding digital infrastructure development, the hospital increased investment in IT systems and achieved notable advancements in digital storage, data processing, and data sharing. These efforts were recognised through the Golden Tripod Award for China Medical and Health Information Technology in the category of exemplary institutions, reflecting the hospital's strong institutional support for the development of digital infrastructure. Regarding medical demand satisfaction, Guanghan People's Hospital has actively strengthened its leading role within the regional healthcare system by establishing multiple specialised centres, including the Guanghan Critical Care Maternal and Child Care Centre, the Guanghan Neonatal Critical Care Centre, the Guanghan Sterilisation and Supply Centre, the Guanghan Medical Quality Control Centre, and the Guanghan Remote Medical Diagnosis Centre. These initiatives were designed to address patients' practical healthcare needs better. Overall, Guanghan People's Hospital has addressed peer pressure by enhancing digital infrastructure development and maintaining high levels of patient satisfaction with medical care. Through this coordinated approach, the hospital has achieved a high level of dynamic capability in medical services.

5.1.3 Configuration and case examples of the competition-driven type

Configuration 3: Innovation-driven type. This configuration reflects efforts to meet medical needs primarily through two aspects: digital innovation capability and digital infrastructure development. Evidence for this configuration is found in the core condition combination DIC * DID * MDS, within which two paths were identified: fsDIC * fsDID * fsMDS * fsODC *~fsDRS (Path 4) and fsDIC * fsDID * fsMDS *~fsPCP *~fsODC * fsDRS (Path 5). In Path 4, digital innovation capability, digital infrastructure development, and medical demand satisfaction serve as core conditions, while organisational digital concern acts as a peripheral condition. Digital resource supply is absent as a peripheral condition. This configuration enables achieving high dynamic capability in medical services. In Path 5, digital innovation capability, digital infrastructure development, and medical demand satisfaction remain the core conditions, while digital resource supply acts as a peripheral condition. Peer competition pressure and organisational digital concern are absent as peripheral conditions. This configuration likewise leads to high dynamic capability of medical services.

Examples of hospitals representing the innovation-driven type include Sichuan Science City Hospital and Zhongshan Huangpu People's Hospital in Guangdong Province. Taking Sichuan Science City Hospital as an example, the hospital covers 59 acres, operates 750 inpatient beds, and employs 1,024 staff members. Founded in 1958 and having developed over more than six decades, it has become a tertiary-grade comprehensive hospital integrating medical services, scientific research, teaching, occupational disease prevention, and nuclear emergency response. It is the only designated occupational disease diagnostic institution in Mianyang City and is a member hospital of the West China Hospital Medical Consortium. Since 2020, the hospital has prioritised digital development, with digital innovation capability, digital infrastructure development, and medical demand satisfaction acting as core conditions for strengthening the dynamic capability of medical services. Regarding digital innovation capability, the hospital has actively built research and innovation capacity. It has undertaken more than 50 provincial and municipal research projects, received one second prize from the Sichuan Science and Technology Progress Award, two third prizes from the Sichuan Medical Association Science and Technology Progress Award, thirteen first, second, and third prizes from the Sichuan Science City Science and Technology Progress Award, and one third prize from the Mianyang Science and Technology Progress Award. The hospital has published 24 SCI-indexed papers and 185 articles in national core journals and in Peking University-indexed journals. It has participated in the compilation of 48 academic books and obtained 141 patents.

Four national continuing education programmes have been organised, and more than 100 provincial and municipal programmes have been held. More than 60 new technologies receive approval each year. In relation to digital infrastructure development, Sichuan Science City Hospital has focused on establishing a comprehensive digital foundation by developing online diagnosis and treatment support platforms, upgrading data interfaces to enable cross-platform data sharing, and constructing new data storage centres. Regarding medical demand satisfaction, the hospital has responded to local patient needs by focusing on key areas, including occupational disease diagnosis, prenatal screening, and nuclear and radiation prevention and control, to address region-specific healthcare needs. By integrating digital innovation capability, digital infrastructure development, and medical demand satisfaction, Sichuan Science City Hospital has achieved high dynamic capability in medical services.

5.1.4 Configuration and case examples of the internal and external dual-driven type

Configuration 4: Internal-external dual-driven type. This configuration is jointly determined by external competitive pressure and internal managerial attention. Evidence is provided by the core condition combination PCP*ODC, within which four solution paths were identified. Among these, Paths 6 and 7 exhibit relatively low coverage. The identified paths are as follows: fsDIC * fsDID * ~fsMDS * fsPCP * fsODC (Path 6)； fsDIC * fsDID * fsPCP * fsODC * ~fsDRS (Path 7); fsDIC * ~fsMDS * fsPCP * fsODC * fsDRS (Path 8); fsDID * ~fsMDS * fsPCP * fsODC * fsDRS (Path 9). In Path 6, peer competition pressure and organisational digital concern act as core conditions, while digital innovation capability and digital infrastructure development serve as peripheral conditions. Medical demand satisfaction is absent as a peripheral condition. This configuration enables high dynamic capability of medical services. In Path 7, peer competition pressure and organisational digital concern remain the core conditions, with digital innovation capability and digital infrastructure development acting as peripheral conditions. Digital resource supply is absent as a peripheral condition. This configuration likewise supports the high dynamic capability of medical services. In Path 8, peer competition pressure and organisational digital concern serve as core conditions, while digital innovation capability and digital resource supply exhibit marginal conditional effects. Medical demand satisfaction is absent as a peripheral condition. Under this configuration, high dynamic capability of medical services is achieved. In Path 9, peer competition pressure and organisational digital concern remain core conditions, while digital infrastructure development and digital resource supply remain peripheral conditions. Medical demand satisfaction remains

absent as a peripheral condition. This configuration also results in high dynamic capability of medical services.

Examples of the internal and external dual-driven type include Yunnan Lincang People's Hospital, Longchang Traditional Chinese Medicine Hospital, and Jiangyou People's Hospital. Taking Yunnan Lincang People's Hospital as an example, it is a tertiary-grade A comprehensive institution integrating medical treatment, emergency care, teaching, scientific research, disease prevention, rehabilitation, and health management. It is a member hospital of the West China Medical Association and serves a population of more than 3 million across 8 counties, districts, and surrounding border areas. The hospital has 2,560 designated beds, 1,816 in operation, and employs 1,923 staff members. Since 2020, the hospital has focused on digital development, with peer competition pressure and organisational digital concerns as core conditions for strengthening the dynamic capability of medical services. In response to Peer competition pressure, Yunnan Lincang People's Hospital has established long term collaborative relationships with multiple large medical institutions, including Wuhan Union Medical College Hospital, the Pearl River Hospital of Southern Medical University, Yunnan Cancer Hospital, West China Hospital of Sichuan University, Kunming Medical University and its affiliated hospitals, the First People's Hospital of Yunnan Province, and Kunming First People's Hospital. Through these partnerships, the hospital has enhanced its competitive capacity and improved its ability to respond to external competitive pressures. With respect to organisational digital concerns, Yunnan Lincang People's Hospital has strongly supported the application of digital technologies, actively recruited digital professionals, introduced digital services and systems, and promoted hospital-wide digital transformation. Through the combined influence of peer competition pressure and organisational digital concern, Yunnan Lincang People's Hospital has achieved notable improvements in the dynamic capability of medical services.

5.2 A compendium of strategies to enhance the dynamic capabilities of medical services in the West China Hospital Consortium

5.2.1 Targeted allocation of digital resources based on medical demands

First, resources should be allocated in a targeted manner according to specific demand units. Taking the entire medical service cycle as the logical framework, the needs of general patients can be divided into four demand units: prevention, diagnosis, treatment, and rehabilitation.

Digital technologies should be applied to better address patient needs at each of these four stages. In the prevention stage, emphasis should be placed on timeliness, with digital resources allocated towards health monitoring and disease prevention. Real-time data collection and dynamic analysis capabilities should be ensured through the use of smart wearable devices, including terminals that monitor heart rate, blood oxygen, and blood glucose levels, coupled with regional medical big data platforms. This enables the establishment of a closed-loop system integrating data collection, analysis, and early warning functions. By comparing monitoring data, including blood pressure trends and abnormal glucose fluctuations, with patients' medical histories and regional disease prevalence data on the platform, risk assessment reports can be generated and potential disease risks communicated promptly to both patients and clinicians. This approach supports the shift from passive treatment to proactive prevention. In the diagnostic stage, efficiency and accuracy are prioritised. For imaging diagnosis, AI-assisted image analysis systems can be deployed, with diagnostic precision enhanced through repeated large-scale data training. For clinical decision making, an integrated clinical decision support system combining electronic medical records, laboratory reports, and clinical guidelines can provide physicians with diagnostic and treatment recommendations and risk alerts. Data processing capacity can be strengthened by upgrading medical data platforms to enable real-time data integration and rapid retrieval, thereby reducing processing time and minimizing diagnostic errors or workflow disruptions arising from fragmented data systems. In the treatment stage, emphasis should be placed on remote diagnosis and treatment technologies. High-definition remote consultation platforms can be established to enable real-time consultation and surgical guidance between core hospitals and primary institutions. This promotes the extension of advanced medical expertise to less developed regions. Surgical robotic systems may be introduced to reduce operational error, enhance clinical precision, and improve surgical outcomes in complex procedures. In addition, clinicians can be equipped with portable digital diagnostic terminals, including mobile ward-round systems and intraoperative imaging tablets, to facilitate real-time access to patient information during procedures and efficient post-treatment documentation, thereby supporting continuous information flow and data sharing. In the rehabilitation stage, to address the issue of "information silos", a cross-institutional and cross-system rehabilitation information platform should be developed. This platform can integrate diagnosis and treatment records, rehabilitation evaluation reports, and medication data from multiple hospitals, enabling seamless continuity of information when patients are transferred between facilities. For patients undergoing home-based rehabilitation, remote monitoring devices can be deployed alongside platforms that provide personalised

rehabilitation plans. Online interaction mechanisms between clinicians and patients can support real-time adjustment of training and recovery programmes.

Second, mechanisms for resource sharing and circulation should be established. This begins with evaluating idle digital resources to determine circulation feasibility. Specialists should assess whether idle resources held by core hospitals meet the needs of primary institutions and evaluate the functional integrity of these resources. Circulation priorities should be set based on the urgency of grassroots needs, including requirements for routine disease diagnostic tools in county hospitals, thereby avoiding inefficient resource transfers. A dedicated technical team and scheduling platform should then be developed. Technical teams can undertake necessary modifications to transferred resources, including simplifying the operating interfaces of advanced equipment and optimising data transmission protocols, so that devices can be smoothly integrated into primary healthcare workflows. A digital scheduling centre can receive applications from primary institutions detailing resource needs and usage periods. Allocation decisions can then be made by matching demand urgency with available idle resources to complete transfers within specified time frames. Subsequently, effectiveness monitoring and feedback mechanisms should be introduced. Usage frequency and failure rates of circulating resources can be tracked in real time through digital platforms and combined with feedback from clinical staff and patient satisfaction data to assess adaptation effectiveness. For resources with low utilisation, root causes should be analysed, targeted technical modifications implemented, or allocation directions adjusted, ensuring continuous optimisation of the resource circulation mechanism.

Third, a support system centred on technical and human resources should be established. In terms of technical support, cross-departmental teams can be formed to address supply-and-demand mismatches and design tailored solutions. Where compatibility issues exist between high-level digital resources from core hospitals and data platforms used by primary institutions, customised software and hardware solutions should be developed to ensure data compatibility and sharing, thereby improving resource utilisation. A remote technical support platform can provide real-time assistance through online diagnostics, video guidance, and related tools, ensuring that technical problems do not undermine operational effectiveness. A hierarchical and differentiated training system should be implemented to enhance digital resource utilisation and management capacity across institutions. Primary medical staff can receive training on the use of digital equipment and data management procedures supported by applied case learning. Management and scheduling personnel can be trained in resource evaluation methodologies and data feedback analysis to enhance coordination efficiency. Maintenance staff should

receive technical training on fault diagnosis and compatibility debugging to ensure stable system operation. In addition, mechanisms to promote downward mobility for technical professionals from core hospitals can be developed. Regular on-site guidance, online consultations, and experience sharing can strengthen knowledge transfer and provide ongoing human resource support for digital resource allocation and circulation activities.

5.2.2 Establishing a multi-dimensional evaluation and optimisation system for demand–resource matching

First, a dual-end evaluation index system should be established to assess both demand and resource dimensions. On the demand side, patient needs and institutional needs should be considered. The patient-need dimension should focus on the core principle of meeting medical needs, covering both clinical and non-clinical service requirements. Clinical needs include accurate diagnosis and treatment of complex and severe illnesses, long-term management of chronic diseases, and other essential medical requirements. Indicators such as response timeliness and the suitability of diagnostic and treatment plans may be used. Non-clinical needs involve experiential aspects of care, such as the convenience of service processes, the effectiveness of doctor-patient communication, and the comprehensiveness of health guidance, with patient satisfaction and experience assessment as key indicators. Institutional needs should be differentiated by organisational level. Core hospitals emphasise research and innovation needs, adopting indicators such as the number of high-end digital diagnostic technologies, the establishment of clinical research centres, and the scale of innovation-related activities. Regional medical centres emphasise the need for diagnostic and treatment resources for common diseases, using indicators such as the configuration of digital platforms, the extent of regional sharing of examination results, the effectiveness of cross-regional collaboration, and the establishment of standardised treatment guidelines. Grassroots units prioritise basic medical resources, such as the availability of digital tools for chronic disease management, the number of portable basic medical devices, and the effectiveness of referral linkages with higher-level institutions. On the resource side, both digital resources and medical resources should be comprehensively evaluated. Digital-resource indicators include hardware (intelligent diagnostic terminals, distributed data-storage devices, mobile ward-round systems), software systems (electronic medical records, remote-consultation platforms, chronic-disease management modules), network support, and the overall adaptability between supply and demand, as well as actual utilisation efficiency (for example, device usage frequency and system-function utilisation). Medical-resource indicators include the rationality of equipment

allocation, alignment between research/training resource inputs and innovation needs (such as the appropriateness of research-fund distribution), and the feasibility of cross-institutional resource sharing (for example, ease of cross-hospital equipment scheduling and frequency of expert-resource deployment). The entire indicator system should be jointly developed by a cross-functional team comprising clinical departments, information management units, financial departments, and patient representative groups. This ensures that the indicators are fully aligned with actual diagnostic and treatment scenarios, reflect real patient needs, and highlight the central role of cross-functional collaboration in the design of evaluation systems.

Second, a dynamic evaluation mechanism integrating data monitoring and qualitative research should be established. At the quantitative monitoring level, a real-time data-collection system should be built on the medical consortium information integration platform. On the demand side, patient medical data such as disease categories, visit frequency, and referral rates should be captured alongside patient satisfaction indicators. After data cleaning and integration, demand trends, including seasonal fluctuations in chronic disease prevalence and the regional distribution of complex illnesses, can be analysed. On the resource side, digital resource utilisation records should be extracted, including server computing utilisation, device activation rates, and software function access frequency. Medical resource allocation data, such as cross-departmental equipment scheduling and research funding volume, should also be obtained to assess supply adequacy and utilisation efficiency dynamically. At the qualitative research level, a multi-stakeholder interview mechanism should be conducted. On the demand side, communication sessions should be organised that involve department heads, frontline medical staff, and patient representatives. Clinical staff may identify issues such as insufficient digital tools for chronic disease management in grassroots departments. Patient representatives may provide feedback on service experiences, such as complex online follow-up processes or inconvenient methods for retrieving examination reports. For the resource side, consultations should be conducted with IT specialists, financial personnel, and equipment management staff. IT personnel can analyse causes of low digital resource utilisation, including limited technical training or misalignment between system functions and clinical practice. Financial personnel can identify sources of idle assets, such as inefficiencies caused by low equipment utilisation. Through comprehensive participation, hospitals can rapidly identify emergency demand events such as public health crises and detect abnormal resource conditions, such as equipment failures.

5.2.3 Gradual iteration of medical infrastructure

Firstly, a demand-oriented evaluation system is established. Based on the actual needs of

medical services provided by the West China Hospital Alliance, infrastructure needs are classified according to the urgency of medical demand through patient surveys, interviews with medical staff, and analysis of clinical data. High-frequency facilities, such as emergency equipment in the emergency department and chronic disease monitoring equipment in primary hospitals, are prioritised. With reference to digital infrastructure construction, gaps in existing facilities are identified, including delays in surgical image transmission and insufficient data storage capacity in primary hospitals, to clarify discrepancies between current infrastructure development and service demand. At the same time, based on the actual operating costs of different medical units, facilities that require high investment but are currently experiencing temporarily low demand are shelved. A priority upgrade list is then established to accurately identify infrastructure types and entities requiring the most urgent iteration, thereby avoiding resource mismatches.

Secondly, differentiated iterative measures are developed for both medical and management scenarios. Medical scenarios focus on clinical processes and prioritise facilities that directly affect medical quality and patient safety. For example, in the emergency department, upgrading auxiliary diagnosis and treatment systems and portable emergency monitoring equipment shortens emergency response time. In inpatient settings, intelligent interactive terminals are deployed to enable real-time uploading of medical advice queries, postoperative guidance, and rehabilitation data. In chronic disease management, intelligent detection devices and cloud-based data synchronisation systems are configured for grassroots hospitals to support patients in seeking medical treatment from home. Management scenarios focus on improving operational efficiency, with priority given to upgrading cross-institutional resource-sharing platforms to enable dynamic allocation of equipment and talent between core hospitals and grassroots units. With the implementation of digital intelligent management systems, medical data and quality assessment reports are generated automatically, improving decision-making efficiency and addressing issues such as low cross-level management collaboration and delayed quality supervision.

Thirdly, a guarantee system integrating policy, talent, and funding support is established. At the policy level, priority is given to the iteration of infrastructure projects supported by national medical policies or local medical project regulations to obtain financial support, tax exemptions, or green channels. At the talent level, training programmes tailored to different iteration needs are developed, including training in intelligent device operation, digital analysis tools, hospital information system operation, and applications of digital management platforms. Senior talent in digital resource development and infrastructure maintenance is introduced, and

cross-departmental, interdisciplinary, and cross-professional talent teams are established. A flexible talent flow mechanism is implemented, in which digital technology talents and senior medical personnel from core hospitals are assigned to guide and support grassroots medical units, and relevant personnel from grassroots hospitals rotate to core hospitals for training to address technical and management capacity gaps. At the funding level, multi-channel funding collection and precise allocation methods are established. Core hospitals actively apply for national special funds to support infrastructure construction related to scientific research, while grassroots units apply for local government financial subsidies to ensure corresponding infrastructure development. Allocation relies on hospital data platforms to collect real-time demand data across different levels and scenarios, and allocation lists are updated regularly based on this data. For instance, when the utilisation rate of specific equipment increases alongside patient satisfaction, the construction budget for that infrastructure can be increased in the following quarter. Conversely, budgets for equipment with lower utilisation are reduced and reallocated to higher demand areas to achieve dynamic optimisation of fund allocation. In addition, regardless of hospital level, a hospital-enterprise collaboration model can be explored to attract social capital for participation in infrastructure development. Hospitals may provide medical teams, while social enterprises contribute funding to establish internal health service centres. This approach utilises idle hospital resources, alleviates financial pressure, and supports the sustainable development of medical infrastructure iteration.

Thirdly, establish a guarantee system that integrates policy, talent, and funding support. At the policy level, priority should be given to advancing infrastructure construction through policies such as national medical policies or local medical project support regulations, to secure financial support, tax exemptions, or green channels. At the talent level, develop talent training programs tailored to different iterative needs, such as training on intelligent device operation, digital analysis tools, hospital information system operation, and digital management platform applications; Introduce senior talents in digital resource development and infrastructure maintenance, and establish a cross departmental, interdisciplinary, and cross professional talent team; Establish a flexible talent flow mechanism, on the one hand, arrange digital technology talents and senior title medical personnel from core hospitals to guide and learn in grassroots medical units, and on the other hand, arrange relevant personnel from grassroots hospitals to rotate and learn at the core level, to solve the technical and management shortcomings of grassroots talents. At the funding level, establish multi-channel funding collection and precise allocation methods. For example, core hospitals actively apply for national special funds to support infrastructure construction related to scientific research, while grassroots units need to

apply for local government financial subsidies to ensure corresponding infrastructure construction; For the allocation method, it is necessary to rely on the hospital's data platform to collect real-time demand data from various levels and scenarios, and regularly update the allocation list based on this. For example, if the usage rate of a specific equipment in a hospital increases and patient satisfaction increases, the construction budget for that infrastructure can be appropriately increased in the next quarter, or the construction budget for a specific equipment with a lower usage rate can be reduced and shifted to high-demand areas to achieve dynamic optimisation of fund allocation. In addition, regardless of hospital level, a new model of "hospital+enterprise" can be explored to attract social capital to participate in hospital infrastructure construction. For example, hospitals can deploy medical teams, and social enterprises can invest in establishing internal health service centres. This can not only utilise hospitals' idle resources, but also alleviate financial pressure and ensure the sustainable development of medical infrastructure iteration work.

5.2.4 Dynamic monitoring of external competitive pressure

Firstly, a multidimensional competitive pressure indicator system is established. Based on the TOE theory of collaboration logic, a hierarchical indicator framework is designed across three dimensions: technology, service, and market. The technological competition dimension benchmarks digital innovation capability and digital infrastructure development. Indicators include the number of medical patents generated through digital innovation, communication, and knowledge integration; the number of applications of new information, data storage, and processing tools; the integration rate of medical information data; and the security rate of patient medical information. The service competition dimension relates to the satisfaction of treatment needs. Indicators include patient satisfaction scores, patient waiting time, and the first-contact resolution rate for medical services. The market competition dimension reflects industry competitive pressure. Indicators include the number of patients attending other medical institutions within the region, the level and quantity of cooperative research institutions, and the patient transfer rate. These indicators support the construction of a comprehensive multidimensional monitoring system capable of responding promptly to changes in peer competition and external medical market dynamics.

Secondly, the analysis and transformation of competitive data are strengthened. For data collection, a dual-channel approach is adopted. Hospitals within the West China Hospital Alliance report relevant information through a bottom-up process, with particular attention to competitors exerting higher competitive pressure in the region. Externally, medical big data

platforms developed by official or reputable medical institutions are utilised to obtain patient feedback on medical information and service content. For data processing, advanced database management tools are employed, including AI models that help clinicians improve diagnostic efficiency and accuracy. The application of these tools enhances patient awareness of healthcare needs while ensuring data security. For data conversion, value creation is anchored to practical data service activities. Hospitals utilise several years of historical registration, outpatient, emergency, and seasonal disease data to develop predictive models that estimate patient volume peaks for forthcoming periods. This supports advanced staffing and medication planning, reduces patient waiting time, and minimizes resource idling and waste.

Thirdly, differentiated response strategies are developed to align with the developmental needs of institutions at different levels. Based on the hierarchical structure of core hospitals, regional centres, and grassroots units, tailored strategies are formulated. Core hospitals focus on competition with medical consortia of comparable scale and leading medical centres in other regions. They collaborate with State Key Laboratories to accelerate the development of digital scientific research platforms and strengthen research capability. In parallel, collaboration with pharmaceutical companies and universities is expanded to enhance technological competitiveness and research performance. Regional medical centres respond to competition from peer institutions by prioritising improvements in medical technology and service quality. Measures include recruiting high-level medical talent, adopting advanced medical technologies, and developing comprehensive online medical platforms to optimise diagnostic pathways and enhance patient satisfaction. Grassroots medical units concentrate on competition within surrounding communities. Through medical data platforms jointly developed with medical consortium partners, medical data sharing is implemented to support service delivery models focused on treatment in community settings and to enhance the digital experience of healthcare services.

5.2.5 Adapting infrastructures around digital innovation needs

Firstly, digital innovation needs are accurately identified through the integration of multiple methods. Cross-disciplinary in-depth research is conducted by forming a research team consisting of clinical medical staff, IT personnel, hospital management staff, and patient representatives. Interview methods are primarily used to collect requirements from three areas: clinical demand technology, operational management (e.g., digital resource sharing), and patient experience (e.g., online medical processes), to ensure coverage of all demand scenarios. Secondly, with support from the West China Medical Association's data processing platform,

datasets including digital facility records, electronic medical records, diagnosis and treatment logs, and patient satisfaction data are analysed to explore potential innovation needs. For example, digital tools for routine disease management can be developed based on visit frequency and rehabilitation data for patients with common chronic conditions to improve operational efficiency. In addition, peer competition and industry frontiers are reviewed through real-time monitoring of competitors' digital innovation directions, along with reference to national digital healthcare policies and industry technical standards, to identify internal innovation gaps and emerging needs. Finally, innovation needs meetings to be organised to convene cross-functional teams, including clinical department directors, technical research and development personnel, and research platform leaders. These meetings support brainstorming on advanced technology research and development at core hospitals and basic innovation initiatives at grassroots hospitals, such as the construction of digital platforms, while clarifying priorities for infrastructure adaptation.

Secondly, a dedicated team for infrastructure adaptation is established. This specialised team comprises clinical experts, digital technicians, hospital managers, and researchers, each with clearly defined responsibilities. Clinical experts evaluate the practical applicability of identified innovation needs. Technical personnel assess the technical feasibility of infrastructure adaptation. Managers coordinate the allocation of digital resources. Researchers liaise with core hospital research platforms to obtain technical support. Regular discussions are held to ensure complete process collaboration across requirement identification, facility construction, and adaptation implementation, thereby preventing deviations arising from single-domain decision-making. For example, a hospital data centre may be established, where dedicated personnel analyse information collected from multiple platforms in conjunction with infrastructure adaptation budgets and high-frequency feedback, to determine whether infrastructure upgrades are required.

Thirdly, a demand-based adjustment mechanism is established. Medical consortium hospitals implement real-time monitoring systems based on two categories of indicators. The first includes data generated directly from digital infrastructure operations, such as usage frequency, failure rates, and existing deficiencies. The second contains new feedback from medical personnel and patients collected through digital platforms. Through systematic analysis of these datasets, demands are categorised into emergency demands, such as urgent requirements for information sharing during sudden medical events, and routine demands, such as requests for additional equipment to improve efficiency. Different adjustment measures are applied according to the level of demand priority, and infrastructure adaptation is implemented

in an appropriate sequence. At the same time, a flexible funding mechanism is established to ensure timely financial support for priority demands and the smooth implementation of diverse innovation requirements, thereby reducing the impact of resource delays on adaptation efficiency. Following completion of infrastructure adaptation activities, effectiveness evaluations are conducted using predefined assessment standards and user and patient feedback to ensure that demand identification and infrastructure development remain as aligned as possible.

5.2.6 Learning and improvisation of internal management skills in external competition

Firstly, external pressure sources are dynamically monitored. Using the medical data platform of the core hospitals of the West China Hospital Alliance or trusted third-party information platforms, a competitor-related information analysis team is established across multiple institutions. Professionals from clinical, IT, management, and related fields are integrated to develop a dynamic medical database. Publicly available data from other hospitals on digital-driven services, technological innovation such as AI-assisted diagnostic applications and medical image interpretation, and optimisation of the patient experience, such as online follow-up processes, are monitored. These data are combined with third-party industry reports, patient satisfaction evaluations, and related outcomes to identify competitors' core strengths, including technological innovation capacity and talent management strategies. At the same time, management staff and key medical personnel from member institutions of the medical consortium are organised to participate in case studies focusing on competitor experience in resource management, process optimisation, and technological innovation. Suitable practices are extracted to support improvements in internal management capability.

Secondly, effective mechanisms for external cooperation management are designed. Management models validated by competitors are introduced through diversified approaches. Alliances are actively established with hospitals, medical institutions, or enterprises demonstrating strong performance in digital healthcare management and cross-institutional collaboration. Mature experience in external resource integration and service quality enhancement is acquired through joint projects, such as pilots for digital chronic disease management, and through secondment-based learning for management staff. In parallel, selected member units at different levels within the medical consortium, beginning with grassroots hospitals, serve as pilot sites to ensure operational safety. Acquired management experience is adapted to their practical conditions to implement localised transformation. This approach forms a pilot evaluation and promotion pathway that avoids incompatibility arising

from mechanical replication and ensures that external management experience is translated into real operational capability across the consortium. For example, cooperation can be established with regional hospitals that have particular expertise to develop specialised disease diagnosis and treatment centres for high-risk conditions, including chronic diseases in older adults and common diseases in children. This enables the consolidation of expertise across multiple institutions, shortens treatment cycles, and reduces treatment costs.

Thirdly, an iterative optimisation mechanism based on hierarchical classification is established. Differentiated optimisation plans are developed based on the hierarchical structure of West China Medical Association member units, including core hospitals, regional medical centres, and grassroots institutions. For core hospitals, emphasis is placed on evaluating management and scientific research performance relative to leading competitors in the industry. Regular comprehensive assessments are conducted, focusing on digital technology management, such as big data analysis team development, and on external cooperation mechanisms, including joint research and development partnerships with research institutions. Strategic priorities are adjusted based on evaluation outcomes. For example, when competitors adopt new digital management technologies, targeted learning groups are established to align management practices with industry frontiers. For grassroots institutions, attention centres on fundamental management capacity. Drawing on experience from comparable hospitals delivering grassroots medical services, regular discussion sessions and targeted training programmes are implemented to address practical challenges, including staff's limited familiarity with new management processes and patients' difficulties in achieving timely resolution of routine conditions. Concurrently, feedback from grassroots units on adaptability issues, including infrastructure unsuitable for existing equipment conditions, is collected and communicated to technical teams for timely upgrades and modifications. Furthermore, optimisation experiences from each member unit are consolidated into standardised guidelines and disseminated across the consortium to facilitate cross-level knowledge sharing. This ensures that mature management practices continuously adapt to the varying needs of member institutions and support balanced improvement of overall internal management capability within the West China Hospital Alliance.

5.3 Chapter summary

This chapter summarises the configuration of high medical service dynamic capabilities and elaborates on four improvement cases: the resource-satisfaction configuration case, the

competition-driven configuration case, the innovation-driven configuration case, and the dual-driven internal and external configuration case. In addition, six promotion strategies for enhancing the dynamic capabilities of medical services within the West China Hospital Alliance are proposed. These include targeted allocation of digital resources aligned with medical needs, establishment of a multidimensional evaluation and optimisation system for demand and resource matching, phased iteration of medical infrastructure, dynamic monitoring of external competitive pressure, adaptation of infrastructure to digital innovation needs, and learning and improvement of internal management capabilities under external competition.

Chapter 6: Conclusion and Discussion

This chapter summarises the research process, final results, and insights obtained from the configuration data analysis conducted in this study. The first section provides a review of the research and a conclusive summary of the significant findings. The second section introduces the theoretical and practical contributions of the study. The third section discusses the limitations of the research and outlines directions for future investigation.

6.1 Research findings

This study presents the research questions, collects and analyzes relevant data, and ultimately addresses them. The specific findings are presented in Table 6.1.

Table 6.1 Research problems and conclusions of this study

Serial number	Research question	Conclusion
1	What are the influencing factors of the dynamic capability of medical services in West China Medical Alliance Hospital?	No single factor can lead to high dynamic capabilities in medical services. Instead, the interaction of six factors, including digital innovation capability, digital infrastructure development, organisational digital concern, digital resources supply, medical demand satisfaction, and peer competition pressure, contributes to achieving high dynamic capabilities in medical services.
2	What is the configuration path for improving the dynamic capabilities of medical services in West China Medical Alliance hospitals from the TOE perspective?	The findings indicate four pathways to high dynamic capabilities in medical services: the resource-satisfaction path, the competition-driven path, the innovation-driven path, and the dual internal- and external-driven path.
3	What are the strategies for enhancing the dynamic capabilities of medical services in West China Medical Alliance hospitals?	Based on the identified configuration paths, strategies are proposed, including allocating digital resources, establishing an evaluation system, iterating medical infrastructure, monitoring competitive pressure, adapting infrastructure, and enhancing internal and external management capabilities.

This study explores three central research themes. Firstly, the configuration effects of factors across the technological, organisational, and environmental dimensions, namely digital innovation capability, digital infrastructure development, organisational digital concern, digital resources supply, medical demand satisfaction, and peer competition pressure, on the dynamic capabilities of medical services in West China Hospital Alliance hospitals under a digital

context are examined. Secondly, based on the TOE theory, configuration enhancement pathways for the dynamic capabilities of medical services in West China Hospital Alliance hospitals are proposed. Finally, drawing on these configuration pathways, targeted strategies for strengthening the dynamic capabilities of medical services in West China Hospital Alliance hospitals are developed.

To examine the specific configuration paths, an extensive review of the relevant literature, theories, and models is conducted to inform the development of the research framework and conceptual foundations of the study. Dynamic capability theory is systematically reviewed, including its definitions, key characteristics, influencing factors, and its impact on enterprise competitive advantage. Building on this review, six antecedent conditions of medical service dynamic capability are identified: digital innovation capability, digital infrastructure development, organisational digital concern, digital resource supply, medical demand satisfaction, and peer competition pressure. The relationships among these conditions and medical service dynamic capability guide the construction of the research framework and configuration path analysis.

This study applies the fsQCA method to examine how different configurations of antecedent conditions influence the dynamic capabilities of medical services and to identify multiple pathway combinations through which hospitals within the West China Hospital Alliance can enhance these capabilities. The application of the fsQCA method is appropriate because it effectively captures complex, mixed causal relationships and supports the development of related theoretical interpretations and practical recommendations.

Sample data are sourced from hospitals within the West China Hospital Alliance. Data collection employs a five-point Likert scale questionnaire administered to hospital employees to measure relationships among the study variables. The response scale ranges from 1 (completely disagree) to 5 (completely agree). From 3 June 2025 to 23 June 2025, 40 questionnaires were distributed to executives of the Sino Western Medicine Joint Hospital, and 35 valid questionnaires were returned. Reliability and validity tests are conducted, and the pilot results satisfy expected standards.

Based on feedback from the pilot survey, modifications were made to the questionnaire instrument. During the second phase of data collection, conducted from 1 July 2025 to 20 July 2025, 130 questionnaires were distributed to executives of the Sino Western Medicine Joint Hospital, and 116 were collected as valid. Due to built-in error-prevention measures, all returned questionnaires are valid, yielding an effective response rate of 89.23%.

Data analysis is performed using the fsQCA method. SPSS software is applied to evaluate

factor loadings, Cronbach's alpha coefficients, composite reliability values, and average variance extracted values for each construct. The results indicate that the questionnaire data demonstrate satisfactory reliability and validity. The data are then calibrated and subjected to descriptive statistical analysis, followed by necessary condition analysis to exclude the possibility that any single variable independently generates high dynamic capabilities in medical services. The findings meet the research expectations. Subsequently, the configuration analysis identifies four pathways to achieving high dynamic capabilities in medical services: the resource-satisfaction path, the competition-driven path, the innovation-driven path, and the dual-driven internal and external path.

Research objective 1: To explore the influencing factors of the dynamic capabilities of medical services in West China Hospital Alliance hospitals within a digital context and to construct a theoretical model.

Based on existing literature, the influencing factors are examined from the technological, organisational, and environmental dimensions. These factors include digital innovation capability, digital infrastructure development, organisational digital concern, digital resources supply, medical demand satisfaction, and peer competition pressure. A theoretical model is developed based on these factors.

Research objective 2: To explore the configuration pathways for promoting the dynamic capabilities of medical services in West China Hospital Alliance hospitals.

The study hypothesises that combinations of the six factors across the technological, organisational, and environmental dimensions generate high dynamic capabilities in medical services. The empirical results confirm that no single factor, by itself, produces high dynamic capabilities. Instead, the interaction and synergy among digital innovation capability, digital infrastructure development, organisational digital concern, digital resource supply, medical demand satisfaction, and peer competition pressure produce four configuration paths that lead to high dynamic capabilities in medical services.

Research objective 3: To develop strategies for enhancing the dynamic capabilities of medical services in West China Hospital Alliance hospitals through configuration and case analysis.

Based on the four identified configuration paths, six targeted promotion strategies for enhancing high-level medical service dynamic capabilities are proposed. These findings contribute not only to the theoretical development of dynamic capability research in the medical services sector but also to practical strategic guidance for improving dynamic medical service capabilities within hospitals of the West China Hospital Alliance.

6.2 Research contributions

6.2.1 Theoretical contributions

This study explores the mechanisms for enhancing the dynamic capabilities of medical services in West China Hospital Alliance hospitals under a digital context from three dimensions, namely the technological dimension, including digital innovation capability and digital infrastructure development, the organisational dimension, including organisational digital concern and digital resources supply, and the environmental dimension, including peer competition pressure and medical demand satisfaction. Drawing on dynamic capability theory and the technology organisation environment theory, this study also identifies configuration pathways for achieving high dynamic capabilities in medical services.

The findings demonstrate that a single factor does not drive high dynamic capabilities in medical services. Instead, they result from the combined effects of technological, organisational, and environmental factors. Many existing studies focus on the medical industry from a single perspective. Some examine only the application of digital technology in medical diagnosis, analysing the impact of tools such as electronic medical records, enterprise resource planning systems, and IoT wearable medical devices on integration processes and subsequent dynamic capabilities, including quality, agility, and responsiveness (Chakravorty et al., 2020). Other studies focus exclusively on organisational factors, examining dynamic capabilities within public health sector organisations and exploring how management practices contribute to maintaining performance levels (Loureiro et al., 2023). In contrast, this study develops a comprehensive TOE framework to reveal the distinct configuration pathways through which hospitals within the West China Hospital Alliance achieve high dynamic medical service capabilities in digital environments.

Firstly, this study extends the application of TOE theory in the medical field and overcomes limitations associated with single-dimensional research perspectives. Prior research focusing on isolated dimensions of dynamic capability has failed to capture the collaborative mechanisms across technological, organisational, and environmental dimensions, resulting in a gap between theoretical application and the systemic nature of dynamic capabilities in medical services. This study verifies that no single element, acting independently, produces high dynamic capabilities. Instead, improvements result from the synergistic interaction of multidimensional collaboration across technology, organisation, and environment. In addition, this research demonstrates the equivalence of multiple configuration pathways. Different

combinations of antecedent conditions can yield the same outcome: high dynamic medical service capabilities. This finding extends the application of technology organisation environment theory to situational configuration contexts and strengthens its adaptability within the healthcare domain.

Secondly, adopting an integrated technology organisation environment perspective, this study explores configuration pathways for achieving high dynamic capabilities in hospitals of the West China Hospital Alliance. Four pathways are identified: the resource-satisfaction pathway, the competition-driven pathway, the innovation-driven pathway, and the dual-driven internal and external pathway. The resource satisfaction pathway emphasises meeting healthcare demand through managerial attention and effective resource allocation. The competition-driven pathway focuses on responding to external demand and competitive pressure by improving infrastructure development. The innovation-driven pathway prioritises the simultaneous development of digital innovation capability and digital infrastructure to meet medical service needs. The internal and external dual-driven pathway is characterised by combined pressure from external competition and internal management engagement. From a configuration analysis perspective, these findings systematically expand understanding of pathways for strengthening the dynamic capabilities of medical services.

Finally, this study broadens the application scope of dynamic capability theory in the medical field by clarifying the key antecedent conditions and mechanisms that influence dynamic medical service capabilities. Dynamic capability theory emphasises the integration, development, and reconfiguration of internal and external resources to adapt to rapidly changing environments. However, application in healthcare has largely remained conceptual, with limited systematic examination of specific antecedents. Through technology organisation environment theory and configuration analysis, this study empirically verifies the roles of digital innovation capability and digital infrastructure development in the technological dimension, organisational digital concern and digital resources supply in the organisational dimension, and the combined influence of peer competition pressure and medical demand satisfaction in the environmental dimension. These factors operate through complementary and alternative configuration effects to promote transitions from lower to higher levels of medical service dynamic capability, thereby providing focused theoretical guidance for enhancing dynamic capabilities within the medical services sector.

6.2.2 Practical implications

For practitioners and policymakers in the medical sector, this study highlights specific pathways

to enhance the dynamic capabilities of medical services in a digital context. Strengthening dynamic medical service capabilities is of substantial significance for promoting the core competitiveness of hospitals within the West China Hospital Alliance.

Firstly, this study verifies that achieving high dynamic medical service capabilities in West China Hospital Alliance hospitals requires collaborative engagement across multidimensional factors rather than reliance on a single dominant factor. The findings identify four configuration pathways associated with high dynamic capabilities: the resource-satisfaction pathway, the competition-driven pathway, the innovation-driven pathway, and the dual-driven internal and external pathway. Accordingly, hospitals within the Alliance can undertake targeted adaptation based on their digital technological foundations, organisational management capabilities, and environmental conditions across different institutional levels, guided by the defining characteristics of the four configuration pathways identified.

Secondly, within an increasingly digitalised environment, intensified competitive pressure compels healthcare organisations to seek core conditions that sustain long-term competitiveness. The results demonstrate that all four configuration pathways depend on distinct core conditions. The resource satisfaction pathway prioritises meeting healthcare demand. The competition-driven path centres on responding to external demand and peer pressure. The innovation-driven pathway focuses on developing digital innovation capability and digital infrastructure. Consequently, each hospital within the West China Hospital Alliance should optimise and strengthen capabilities aligned with the core conditions of its selected pathway to ensure effective implementation and performance outcomes.

Furthermore, the research indicates that the four configuration pathways represent integrative collaborative effects across the technology, organisation, and environment dimensions. At the overall governance level, the West China Hospital Alliance should establish cross-dimensional coordination mechanisms to provide institutional support for the effective implementation of these pathways. By targeting the allocation of digital medical resources to specific medical service needs, real-time capture of patient demand information can be achieved using big data technologies. Based on real-time demand analysis, digital resources, including medical big data analytics platforms and remote diagnosis and treatment systems, can be accurately deployed to institutions and service areas with urgent needs. This enables alignment between digital resources and healthcare demand, strengthens resource utilisation efficiency, and establishes a solid foundation for ongoing improvement of dynamic medical service capabilities

6.3 Limitations and prospects

This study integrates practical issues with theoretical gaps to examine the adaptive configuration pathways through which hospitals within the West China Hospital Alliance enhance dynamic medical service capabilities under a digital context. Using the West China Hospital Alliance hospitals as the research sample and drawing on multiple research perspectives, a configuration-adaptation framework based on TOE theory is constructed to explain mechanisms for improving medical service dynamic capabilities, thereby enriching the theoretical foundation of related research. However, several limitations remain, which provide directions for future studies.

This study focuses exclusively on hospitals within the West China Hospital Alliance. Further verification is required to determine whether the findings apply to hospitals outside the Alliance and whether different types of healthcare institutions follow alternative configuration pathways to achieve high dynamic medical service capabilities. Future research may broaden the sample to include medical institutions beyond the West China Hospital Alliance to test the generalisability of these results. Moreover, technological conditions and environmental contexts vary across Alliance hospitals' stages of development, which may lead to differences in their impacts on medical service dynamic capabilities. Future studies should investigate these variations more comprehensively, potentially through comparative case study approaches.

Limitations of variable design in research. The constructs examined in this study, including digital innovation capability, digital infrastructure development, organisational digital concern, digital resource supply, peer competition pressure, and medical demand satisfaction, are developed using established measurement scales, with adaptations for the specific research context. Although confirmatory and exploratory factor analyses and multiple reliability and validity tests have been conducted, broader empirical testing remains necessary to further validate the robustness and objectivity of these measures in future research.

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Annex: Questionnaire

Research on the Dynamic Capability Development of Data Driven Medical Services: Taking the West China Hospital Medical Consortium as an Example

Dear Sir/Madam:

Hello! Thank you very much for participating in this survey on the current status of digital transformation of West China Hospital Alliance. Your feedback will provide us with valuable information, which will help us to deeply analyze the achievements, challenges, and opportunities in the transformation process, and further promote the continuous optimization of the digital transformation of West China Hospital Alliance, contributing to the improvement of regional medical service level. Thank you again for taking the time to participate in this survey! We solemnly promise that the information obtained from this questionnaire will only be used for scientific research. Please feel free to fill it out. Sincerely thank you for your great assistance despite your busy schedule. Thank you!

Part 1: Dynamic Capability of Medical Services

Please evaluate the degree of conformity between the following statements and the situation of your hospital, and mark a "√" next to the most appropriate option or number 4

"1": Strongly disagree; "2": Disagree; "3": neutral; "4": Agree; "5": Strongly agree

1. Regarding cross functional team collaboration, the actual situation in your hospital is:

Describe	Option				
The proportion of cross functional teams formed by hospitals that include professionals from multiple fields such as clinical medicine, information technology, and patient experience management to the planned number of teams	1	2	3	4	5
The proportion of actual work time invested by cross functional team members in the development process of medical service products to the total project development time	1	2	3	4	5
The proportion of new diagnosis and treatment solutions, digital medical service platforms, and other medical service products developed and put into use by cross functional teams to the total number of projects undertaken by the team	1	2	3	4	5

2. Regarding the strategic allocation of medical resources, what is the actual situation in your hospital?

Describe	Option				
The actual amount of resources obtained by hospitals in terms of medical equipment procurement, research funding investment, and allocation of training resources for medical staff has reached the proportion of planned acquisition	1	2	3	4	5
The allocation ratio of medical resources among different innovative projects and the matching degree of project requirements	1	2	3	4	5
The ratio of medical resources invested to the output of innovative projects	1	2	3	4	5

3. Regarding external strategic alliance partnerships, what is the current situation in your hospital?

Describe	Option				
The number of strategic alliances newly established by hospitals with other medical institutions, research institutes, technology enterprises, etc., and the growth rate compared to the previous period	1	2	3	4	5
The proportion of successful promotion and application of new medical service products (such as new diagnostic technologies, remote medical services, etc.) developed by hospitals in cooperation with external strategic alliances to new patient groups or medical market fields, to the total number of joint research and development achievements	1	2	3	4	5
The contribution of advanced medical technology, scientific research achievements, professional talents and other resources introduced by hospitals through strategic alliances to the development of medical service innovation projects and the improvement of medical service quality	1	2	3	4	5

Part 2: Antecedent Factors

Please evaluate the degree of conformity between the following statements and the situation of your hospital, and mark a "√" next to the most appropriate option or number

"1": Strongly disagree; "2": Disagree; "3": neutral; "4": Agree; "5": Strongly agree

1. Digital innovation capability

Describe	Option				
The West China Hospital Medical Consortium has formed a cultural atmosphere that encourages digital innovation and tolerates trial and error. Regular discussions and exchanges related to digital innovation are held, and employees have a high enthusiasm for participating in digital innovation projects.	1	2	3	4	5
In the process of promoting digital innovation, the West China Hospital Medical Consortium fully integrates multi-source knowledge such as medical clinical data knowledge, professional knowledge in the field of information technology, and patient feedback experience knowledge to optimize digital medical services.	1	2	3	4	5
In the digital innovation project of the West China Hospital Medical Consortium, medical staff and technical workers are deeply involved in system development and process optimization, while actively collecting the needs and	1	2	3	4	5

suggestions of customer groups such as patients and their families, and integrating them into digital innovation practices.					

2. Digital infrastructure development

Describe	Option				
The digital storage system of West China Hospital Alliance Hospital can efficiently store and process massive medical data, and its storage system can meet the hospital's future big data growth needs (such as unified storage of electronic medical record data, log files, medical images, etc.); Its data processing platform has powerful computing capabilities and can quickly complete big data analysis tasks to meet the business needs of patients.	1	2	3	4	5
The various digital information platforms of West China Hospital Alliance Hospital can achieve seamless integration of data from different sources (such as electronic medical record system, medical imaging system, experimental information system), ensuring accurate and real-time synchronization of data in the system; The data sharing interface can support data exchange with regional medical information platforms, research institution data platforms, etc., achieving the sharing of medical data on a larger scale.	1	2	3	4	5
West China Medical Alliance Hospital has professional data analysis tools and algorithm models, which can deeply mine medical data (such as analyzing patient disease history, treatment plans, recovery status, etc.), and effectively apply the data analysis results to hospital management (such as improving service processes based on patient satisfaction data).	1	2	3	4	5
The West China Hospital Alliance Hospital has established a comprehensive data security management system, which strictly controls the collection, storage, transmission, and use of data. Advanced data encryption technology is used to prevent data from being tampered with during transmission and storage, and to protect patients' personal information and medical data from being leaked during data analysis and sharing.	1	2	3	4	5

3. Medical demand satisfaction

Describe	Option				
The West China Hospital Medical Consortium has effectively fulfilled its promises made to patients at the beginning of its services, such as providing accurate and efficient diagnosis, personalized treatment plans, and timely allocation of medical resources.	1	2	3	4	5
During the process of receiving medical services in the West China Hospital medical consortium, patients have a positive interaction and relationship with medical staff and service personnel at all levels of the consortium, and can feel respected, cared for, and professionally treated.	1	2	3	4	5
Compared to the ideal medical service status of patients, I am satisfied with the overall situation of the West China Hospital Medical Alliance in meeting my own medical needs (including disease diagnosis and treatment, rehabilitation	1	2	3	4	5

nursing, health guidance, etc.).					

4.Peer competition pressure

Describe	Option				
In terms of data-driven medical services, many competitors of West China Medical Alliance Hospital have widely taken measures to optimize medical processes and improve service quality by utilizing data.	1	2	3	4	5
Competitors of West China Medical Alliance Hospital who actively invest in data-driven medical services, such as using data analysis to assist diagnosis and accurately push health management solutions, have achieved significant benefits, such as increased patient satisfaction and reduced medical costs.	1	2	3	4	5
The competitors of the hospitals within the West China Hospital Medical Consortium that adopt the data-driven medical service model have significantly enhanced their competitiveness in the medical market, attracting more patients to seek medical treatment.	1	2	3	4	5

5.Organize digital concern

Describe	Option				
The core management team of the West China Hospital Medical Consortium attaches great importance to the knowledge and information from aspects such as the cutting-edge technologies in the digital medical field and medical data security policies, regarding them as the key elements for promoting the development of the medical consortium.	1	2	3	4	5
The core management team of the West China Hospital Medical Consortium often contemplates how to deeply integrate the knowledge and information such as medical big data analysis technology and AI-assisted diagnosis system with the businesses like the optimization of the internal diagnosis and treatment processes and the enhancement of patient services within the medical consortium.	1	2	3	4	5
The core management team of the West China Hospital Medical Consortium often conducts in-depth interpretations of knowledge and information such as national digital medical development policies and industry digital transformation standards, and explores the directions and strategies suitable for the development of the medical consortium from them.	1	2	3	4	5
The core management team of the West China Hospital Medical Consortium has invested a great deal of time and effort in researching, analyzing and following up on knowledge and information such as innovative medical digital technologies and the data collaboration and sharing model within the medical consortium.	1	2	3	4	5

6. Digital resources supply

Describe	Option				
The expenditures of West China Hospital Medical Consortium in hardware equipment procurement (such as intelligent diagnosis and treatment terminals, data center servers), software and IT service procurement (medical data analysis software, system operation and maintenance services), and	1	2	3	4	5

telecommunications network construction (5G medical private network, data transmission dedicated line) can fully meet the digital resource supply needs of the medical consortium.					
The existing digital hardware assets (such as intelligent surgical equipment and regional automated inspection instruments) and medical professional software (electronic medical record systems, remote consultation platforms) of the Huaxi Hospital Medical Alliance can ensure the effective supply of digital resources within the medical alliance in terms of both quantity and functionality.	1	2	3	4	5
The West China Hospital Medical Consortium provides each employee with digital technology equipment (mobile ward rounds, portable diagnostic devices), software and IT services (medical APP authorization, cloud storage), and telecommunications support (work flow packages, remote collaboration networks) to meet their daily digital work needs.	1	2	3	4	5
The proportion of standardized digital workstations (integrating multiple medical systems and supporting real-time data sharing) in various medical institutions of the West China Hospital Medical Consortium can meet the work needs of the consortium for digital medical services and digital resource supply.	1	2	3	4	5

Part 3: Basic Information

Gender： [ ] male [ ] female
Your age (years)： [ ] 18-30 years old [ ] 31-45 years old [ ] 46-60 years old [ ] Above 61
Your highest education level:： [ ] Specialized and below [ ] Undergraduate [ ] Master’s degree or above
Your hospital type:: [ ] Core Hospital (West China Hospital Headquarters) [ ] Member units of closely knit medical consortia (municipal hospitals) [ ]Grassroots member units of medical consortia (county-level hospitals+community health service centers) [ ] Other relevant cooperative institutions
Compared to the per capita GDP in China, the per capita GDP level in the area where your hospital is located： [ ] Below average level [ ] Close to the average level [ ] Above average level
The number of employees in your hospital： [ ] Less than 100 people [ ] 101-500 people [ ] 501-1000 people [ ] 1001-2000 people [ ] More than 2001 people

Establishment time of your hospital [ ] Less than 5 years [ ] 5-10 years [ ] 11-20 years [ ] Over 21 years
The proportion of R&D investment in your hospital's total expenditure in the past year [ ] Less than 1% [ ] 1%-3% [ ] 3%-5% [ ] 5%-10% [ ] More than 10%
Province of your hospital：_____
City of your hospital：_____
Name of your hospital：_____