

Research on Configuration Path of Digital Transformation of Service Industry in Guangxi based on TOE Model

Bowen Zheng, Haoyang Xu*, Wengui Liu, Zhichao Li, Meng Huang
Guilin University of Electronic Technology, Guilin, Guangxi, China
*Corresponding Author.

Abstract: The digitization process has bestowed Guangxi with a fresh impetus for development. Conducting research on the driving forces and implementation strategies of Guangxi's digital transformation is instrumental in promoting the digitalization of its service industry and expediting the pace of industry construction. This study constructs an influential factor model based on the TOE framework to explore the transformative dynamics within Guangxi's service industry. By employing fuzzy set qualitative comparative analysis (fsQCA), it reveals that technology, organization, and environment play distinct roles in driving the digital transformation of Guangxi's service industry. Moreover, three combination paths—environment-driven, organization-environment driven, and comprehensive driven—demonstrate have high efficiency in facilitating this transformation process. These research findings not only contribute to existing literature on digital transformations within Guangxi's service industry, but also offer theoretical insights for systematically advancing such transformations.

Keyword: FsQCA; Configuration Path; Digital Transformation; TOE Theoretical Framework

1. Introduction

As a representative province of karst landform, Guangxi Zhuang Autonomous Region has numerous scenic spots, and Guilin, a representative city, has the reputation of "Guilin landscape is the best in the world". With the decline and depletion of resources, the tourism service industry in Guangxi is faced with the following difficulties: single industrial structure, fragile economic development, deterioration of ecological

environment and sharp social contradictions. These problems make the tourism service industry in Guangxi face a series of outstanding contradictions and difficulties that cannot be transformed. The existing industrial structure is single, mainly relies on tourism, the lack of diversified industrial development, limits the sustainable development of the economy. The fragility of the economy has also led to sensitivity to external economic fluctuations, and once the tourism industry is adversely affected, the development of the entire service industry will be affected. The epidemic in the past three years has dealt a blow to Guangxi's tourism industry, which has further implicated the healthy development of the service industry^[1].

In addition, Guangxi tourism service industry is also facing the problem of ecological environment deterioration. Overexploitation and unreasonable use of resources have brought serious damage to the local ecological environment, which has brought negative effects on the long-term development of tourism. The deterioration of the ecological environment may also lead to a decrease in tourists' interest in Guangxi's tourism industry, thus affecting the development of the service industry. At the same time, the sharpening of social contradictions is also one of the difficulties faced by Guangxi tourism service industry. Due to the unbalanced development of tourism, the unfair distribution of resources, and the widening gap in employment and income, social conflicts are becoming increasingly acute, which poses challenges to social stability and harmony, and further threatens the sustainable development of tourism and service industries.

Therefore, it is of great significance to study the multiple factors of service industry transformation in Guangxi, identify its synergistic effect based on the perspective of configuration, and further explore the efficient

digital transformation path of tourism cities. Accordingly, this paper will develop a digital strategy. First, organizations need to clarify their goals and vision for digital transformation. This includes identifying the core values of digital transformation and the desired outcomes. Developing a digital strategy will help to plan and guide the digital transformation process as a whole. In the specific operation, this paper chooses the fsQCA method (which is a tool based on fuzzy set theory, which can deal with fuzzy and dynamic research objects, and is suitable for the situation where the influence of multiple factors on a specific result is uncertain or mixed).

This paper takes technology-organization-environment (TOE) as the theoretical framework and adopts fs/QCA method to study the groups and paths of digital transformation of service industry in Guangxi from the perspective of configuration.

2. Analysis Framework

2.1 Framework

The digital transformation of the service industry in Guangxi, which is related to the use of big data and other technologies in the field of public services, is essentially the development and adoption of innovative technologies by public organizations. For the research on this type of problem, TOE theoretical framework can provide a large explanatory space. TOE theoretical framework is proposed by Tornatizky et al.^[2]. It refers to the analytical framework composed of three elements: Technology, Organization and Environment. It is used to assess and analyze the challenges and impacts an organization or business faces when introducing new technologies or undergoing digital transformation. The TOE framework can help understand and solve problems in technology adoption and innovation processes, as well as the interaction between technology and organizations and the environment.

Specifically, the TOE framework contains the following three dimensions:

(1) Technology: The technical dimension mainly focuses on the characteristics, functions, costs and feasibility and reliability of new technologies. This includes an assessment of the technology's innovation,

usability, interoperability, etc. The characteristics and performance of a technology affect its adoption and application in an organization.

(2) Organization: The organizational dimension mainly focuses on the internal structure, culture, resource allocation and decision-making process of the organization. This includes organizational capabilities, management support, personnel training, and the organization's ability to adapt to change. The characteristics and capabilities of the organization affect the process of technology adoption and application.

(3) Environment: The environmental dimension mainly focuses on the impact of external environment on the introduction and application of technology, including market demand, policies and regulations, competition pattern, and industry standards. The changes and requirements of the external environment will affect the market adaptability and sustainable development of the technology.

By combining these three dimensions, the TOE framework can help organizations identify barriers and opportunities to technology adoption and better support the introduction and application of technology. For example, the TOE framework can help organizations assess the adaptability and feasibility of new technologies and identify the resources and capabilities needed for organizational change, while taking into account the impact and requirements of the external environment.

The TOE framework is widely used in research and practice to assess and analyze factors and influences in technology adoption and innovation processes. It can help organizations better understand and respond to the complex issues faced by technology introduction and digital transformation in order to improve the theoretical support for successful adoption and application of new technologies, while TOE framework theory is inadequate in dealing with the combination of relationships between multiple technology application scenarios. In other words, it is impossible to explore which linkage matching mode can produce better results among the three levels of technology, organization and environment factors, and the configuration thinking contained in QCA method can just make up for this deficiency. Therefore, based

on TOE theoretical framework, this paper intends to use QCA method to explore the influencing factors and realization path of the digital transformation of the service industry. By referring to the research on online government service capability, data open performance, big data industry development capability and other related fields, the factor analysis framework for the digital transformation of public services is constructed from the three levels of technology, organization and environment (Figure 1).

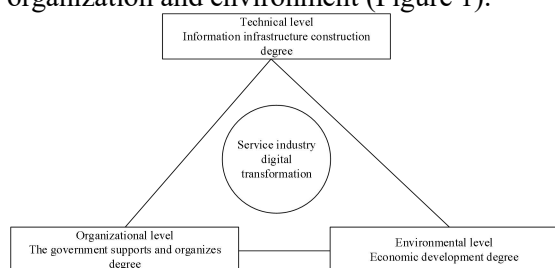


Figure 1. TOE Frame

The technical dimension includes the extent to which information technology facilities are built, and from the perspective of the service industry it measures whether the infrastructure is adequate, reliable, secure and capable of supporting effective information exchange and data transmission. Such as network coverage and bandwidth, communications facilities and devices, data centers and cloud computing, information security and privacy guarantee digital infrastructure. The evaluation of the degree of information infrastructure construction helps to understand the current situation and challenges of a region or organization in digital transformation and information construction. It is a key digital evaluation index of service industry.

At the organizational level, there are two secondary conditions: the support of the autonomous region government and the organizational construction. The support of the autonomous region government is a crucial influencing factor for the digital transformation, and the government needs to introduce relevant policies and regulations to regulate and guide the digital transformation. On the one hand, the importance attached by the autonomous region government to digital transformation also deeply affects the progress of digital transformation. The real challenge in the process of promoting digital transformation is not technical capability, but overcoming deep-rooted political and

organizational differences within the government. Only by breaking such differences can data sharing be truly realized. Make the interconnection of data play its real utility, and empower the digital transformation of Guangxi's service industry.

The environmental level includes two secondary conditions: public demand and economic development level. The development process of digital transformation is closely related to the economic development level of the autonomous region, and the support of technical equipment, the introduction of talents, and the implementation of relevant policies all require a large amount of financial support. Domestic and foreign studies also show that regions with higher economic development level are more likely to produce high-level innovative activities. With the increasing material and cultural needs of our people, the public has put forward higher requirements for the quality of services. Broadband network, data privacy and security, electronic payment and electronic identity authentication, medical services, and entertainment activities all directly reflect the needs of the public. The government and enterprises also need to use big data and higher scientific and technological levels to empower the service industry. To satisfy popular demand.

3. Research Design

3.1 Research Method

Because TOE theoretical framework has shortcomings in dealing with the relationship combination between multiple technology application scenarios, and the configuration thinking contained in QCA method can make up for this deficiency, this paper intends to explore the influencing factors and realization path of service digital transformation by using QCA method on the basis of TOE theoretical framework. However, the level of digitization is unknown, so it is necessary to extract data from different regions in the autonomous region to analyze the outcome variables and condition variables. Secondly, the research purpose of this paper is to learn from the advanced experience of the regions with a high level of digitization to provide conditions for the evaluation and analysis of the digital transformation of the service industry in Guangxi. Therefore, the fs/QCA method is

more suitable for the study of the digital transformation of the service industry in Guangxi.

3.2 Variables and Assignments

3.2.1 Result variable

This paper focuses on the digitization level of the service industry in Guangxi, and takes the White Paper on the Evaluation of the Regional Development Level of Big Data in China as the basis for assigning the result variable. The report is researched and summarized by a research institution directly under the Ministry of Industry and Information Technology of China, and has high credibility. Based on this, this paper will rank the digitization level of each city in the autonomous region. The result variables are assigned according to the fs/QCA method using the rule, the top seven regions are assigned "1", and the other regions are assigned "0".

3.2.2 Condition variable

The degree of information infrastructure construction. Mobile Internet penetration is a measure of the extent to which mobile device users use the Internet and represents how many people in a region or country access the Internet through mobile devices. An increase in the number of Internet users usually requires a better network connection. When the information infrastructure of a region is improved, the network connection speed is increased, and the network coverage is expanded, the number of mobile Internet users will also increase. Therefore, the number of Internet users is taken as an indicator to measure the degree of information infrastructure construction. The data comes from the Guangxi Statistical Yearbook 2022.

Government support. Successful digital transformation cannot be achieved without the support of the autonomous region government. For reference [3], this paper measures the degree of government support through the number of digital transformation support policies issued by various cities in China. Data from the Digital Economy Development Assessment Report 2022.

Organization building. The advanced experience at home and abroad has verified that setting up a special big data center can break the dilemma of data impenetrability and provide a strong organizational backing for the application of big data. Therefore, this paper

takes the number of big data centers as the basis for measuring the level of organizational construction. The data comes from the Guangxi Zhuang Autonomous Region Data Center Development Plan.

The level of economic development. The improvement of economic development level is usually accompanied by the upgrading and transformation of industrial structure. Therefore, this paper takes per capita GDP as the basis to measure the level of economic development, and the data comes from the Guangxi Statistical Yearbook in 2022.

Public demand. The increasing demand for the service industry requires the public to have certain data reception and data processing capabilities. (Ma Liang) [4] Research shows that the education level of the public is in direct proportion to the ability to process the demand for big data. Therefore, this paper takes the proportion of the population above university education in the population of each region as the basis for measuring the demand for citizens. The data comes from the seventh census of the Guangxi Zhuang Autonomous Region Statistics Bureau in 2020.

3.3 Measurement and Calibration

In this paper, the direct assignment method was used to convert the data into fuzzy membership scores [5], and the five conditional variables were determined to be completely unaffiliated with the result variable, the crossing points and the completely affiliated anchor points through the 95th, 50th and 5th percentiles. (Table 1)

Table 1. Condition Variable

Condition variable	Full membership	Crossing point	Completely unaffiliated
Fixed Internet users	412.689	107.9	57.5015
Proportion of university culture in total population	0.156	0.0841	0.0646
Number of documents supported by the government	8.1	1	0
Gross regional product per capita	78654.7	47051.5	33172.15
Number of data centers	12.85	5.5	2.65

4. Empirical Analysis

4.1 Necessity Analysis

fsQCA 3.0 software was used for necessity analysis, and the results were shown in Table 2. The consistency of each condition is less than 0.9, indicating that there are no necessary conditions for digital transformation, and further configuration analysis is needed.

Table 2. Configuration Solution

	Consistency of solution	The coverage of the solution
Information infrastructure construction degree	0.4528	0.4846
Government support	0.5642	0.5772
Organization	0.5357	0.5897

construction		
Level of economic development	0.6428	0.7834
Public demand	0.5942	0.6131

4.2 Configuration Analysis

Using the fsQCA3.0 software component truth table, the consistency threshold was set to 0.8, the case frequency threshold to 1, and the PRI consistency to 0.75. This paper adopts the presentation form of QCA results proposed by Ragin [6], and uses fsQCA software for analysis to obtain complex solutions, reduced solutions and intermediate solutions. The intermediate solutions are selected for analysis and combined with reduced solutions to distinguish core conditions and edge conditions, and the configuration path shown in Table 3 is obtained.

Table 3. Configuration Path

	Technology—Environment type	Organization—Environment Technology based	Technology—Organization Environment based
Implementation path	1	2	3
Information infrastructure construction degree	●	•	●
Government support		●	
Organization construction	•		•
Level of economic development		•	•
Public demand	•		
Degree of coverage	0.3328	0.2191	0.3515
consistency	0.9433	0.9576	0.9467
coverage	0.7322		
consistency	0.7505		

As can be seen from Table 3, the overall consistency of the configuration exceeds 0.75, the consistency of the five configuration paths exceeds 0.9, and the total coverage rate is 0.7322, with good explanatory power. Among the five configuration paths, according to the existence of core conditions, it can be summarized into three types.

(1) Technology-environment type, information infrastructure construction degree * organization construction * public demand, and the core condition is information infrastructure construction degree. This configuration indicates that when the information infrastructure construction degree is higher, the infrastructure is relatively perfect. Facing the pressure of public demand, the digital transformation of service industry

should be carried out in combination with organization construction. Some technology-environment cities and over-reliance on technological investment to promote the digital transformation of the service industry are prone to fall into technical difficulties, resulting in bottlenecks and stagnation in the transformation. At this time, the slow progress of digital transformation brought about by over-emphasis on infrastructure construction can be balanced by emphasizing organizational construction and public demand. Typical cities corresponding to technology-environment type include Yulin City, Nanning City and Guilin City. For example, Nanning City has a high level of information infrastructure construction, which is in the upper middle level in the country, and provides a relatively perfect

infrastructure environment for the digital transformation of the service industry. According to the data of Guangxi Statistical Yearbook in 2022, the population of Nanning with an education level above university has reached 18.85%, ranking first in the autonomous region. Under the demand pressure of people with high education level and relatively perfect information infrastructure construction, Nanning has achieved a high level of digital transformation of the service industry.^[7]

(2) Organization-environment type, level of information infrastructure construction * government support * level of economic development, the core condition is government support. In regions with relatively perfect information infrastructure construction and high level of economic development, the digital transformation of service industry needs government support. Organization-environment cities include Liuzhou City, Guilin City, Nanning City, etc. Taking Liuzhou City as an example, the level of information infrastructure construction and economic development of the city are among the top five in the autonomous region. On this basis, Liuzhou City published a series of documents such as the "Liuzhou 2022 National Economic and Social Development Plan" and the "14th Five-Year Plan for the Development of Strategic Emerging Industries in Liuzhou City", which mentioned vigorously promoting the digital transformation of Liuzhou's service industry, and these factors jointly contributed to the digital transformation of Liuzhou's service industry.

(3) Technology-organization-environment, level of information infrastructure construction * organization construction * level of economic development, in which the level of information infrastructure construction is the core condition, and the marginal condition is the level of organization construction and economic development. For cities with higher levels of information infrastructure construction and economic development, a higher level of service digitization can also be achieved by improving organizational construction. To improve organizational construction, big data centers and management institutions should be set up. This path involves three levels of technology, organization and environment. Organizational

construction is at the organizational level, information infrastructure construction is at the technical level, and economic development level is at the environmental level. For example, the level of information infrastructure construction and economic development in Guilin is among the top five in the autonomous region, and the number of data centers is relatively large. These factors jointly promote the digital transformation of Guilin.

To sum up, the service industry digital transformation includes three realization paths, and the realization of service industry digital transformation often depends on the coordination among technology, organization and environment. These three paths all contain the degree of information infrastructure construction, among which the degree of information infrastructure construction is the most important variable in two paths, which proves that it is crucial to the digital transformation of the service industry^[8]

5. Conclusion and Enlightenment

5.1 Research Conclusion

Based on TOE framework and from the perspective of configuration, this paper builds a driving factor model for digital transformation of service industry. Combined with relevant literature, five driving factors for digital transformation of service industry are proposed, namely, economic development level, information infrastructure construction level, government support, organization construction and public demand. fsQCA method is used to conduct necessary condition analysis and configuration analysis. The conclusions are as follows:

(1) There is a driver substitution relationship between the three realization paths: under specific conditions, public demand and economic development level can replace each other, and the digital transformation of the service industry can also be realized.

(2) The degree of information infrastructure construction is irreplaceable, and this factor appears in all three paths.

(3) The factors of technology, organization and environment can not promote the digital transformation of the service industry alone, and only the three realization paths generated by the combination of factors can promote the digital transformation of the service industry.

5.2 Research Inspiration

(1) The digital transformation of the service industry is not facilitated by a single factor, but often requires the joint action of multiple levels such as technology, organization and environment, which requires the government and enterprises to have a configuration thinking and pay attention to the coordination of multiple factors.

(2) It is necessary to combine regional characteristics and proceed from reality to promote the construction of information infrastructure by making full use of regional resources and reducing unnecessary waste.

(3) Focus on the substitution relationship between factors. When the organization is unable to provide a factor at a certain level, it can shift its thinking to other alternatives.

Acknowledgements

This paper received the funding from the college Student Innovation and Entrepreneurship project of Guangxi Service Industry digital Transformation Configuration path research: Project number: 202210595037

Reference

- [1] Lv Kun; Pan Junbai; Zhou Yili; Li Beiwei. Government intervention, green finance, and regional innovation capacity: Evidence from panel data of 30 provinces. *China Science and Technology Forum*, 2022(10): 58-60.
- [2] Ragazou K, Passas I, Sklavos G. Investigating the strategic role of digital transformation path of SMEs in the era of COVID-19: a bibliometric analysis using R. *Sustainability*, 2022, 14(18): 11295.
- [3] Guo L, Fang X, Guo F. Incentives, penalties, and digital transformation of enterprises: evidence from China. *Environmental Science and Pollution Research*, 2023, 30(43): 97426-97446.
- [4] Maliang, Niyetong, Configuration Analysis of the Success of Enterprise Digital Transformation. *Finance and Accounting Monthly*, 2023, 44(10):118-125.
- [5] Xu Shuitai, Yuan Beifei. Business environment affect the rate of PPP project landing configuration analysis. *Journal of accounting monthly*, 2021, (22): 115-121.
- [6] RAGIN C C. *Redesigning Social Inquiry: Fuzzy Sets and Beyond*. Chicago: The University of Chicago Press, 2008: 190-212.
- [7] Codá R C, Silva Farias J, Dias C. Interactive value formation and lessons learned from Covid-19: The Brazilian case. *Journal of Quality Assurance in Hospitality & Tourism*, 2022: 1-27.
- [8] Application of QCA method in organization and management research: Orientation, strategy and direction. Zhang Ming; Du Yunzhou. *Journal of Management*, 2019(09): 1312-1323.