



# Research on the Influencing Factors of Digital Transformation of Automobile Manufacturing Enterprises from the Perspective of Configuration

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**Abstract.** It is of great significance to give full play to the role of digital empowerment and clarify the path of value creation for automobile enterprises to the high-quality development of the automotive industry. Based on the results of the literature review related to the digital transformation of automobile enterprises, this study uses the TOE theoretical framework as the basis for analysis, combines the resource base view and high-echelon theory to analyse and refine the influencing factors affecting the digital transformation of automobile enterprises, and constructs a configuration model of the influencing factors of automobile enterprises. Subsequently, the questionnaire was designed and distributed, and a total of 123 valid questionnaires were collected and tested for reliability and validity. Finally, the configuration of the data is studied by fuzzy set qualitative comparative analysis, and six configuration paths of high-level digital transformation of automobile enterprises are obtained, among which H1 has the highest coverage, indicating that the digital transformation of enterprises has the best effect in this configuration, and the realisation path of digital transformation of automobile enterprises is proposed based on this configuration.

**Keywords:** Automotive companies, Digital transformation, Implementation path.

## 1 Introduction

With the rapid development and maturity of technologies such as 5G, big data, cloud computing, and blockchain, the global digital era has begun[1]. With the advent of the digital age, data has become an important factor of production for enterprises, and has become an important driving force for social and economic development. In recent years, digital transformation has risen to a national strategy, and in order to seize the opportunity in the world competition, the world's industrial countries have formulated corresponding policies to achieve the purpose of planning the digital transformation of their own manufacturing industry. In 2012, the United States released the United States National Strategic Plan for Advanced Manufacturing, proposing the development of

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advanced digital manufacturing technologies, including digital foundation, and the purpose of expanding and enriching advanced manufacturing. After proposing "Industry 4.0" in 2013, Germany released the "Germany High-Tech Strategy 2025" in 2018, which stated that digital transformation should be the core of the scientific and technological innovation development strategy; In 2020, Japan proposed a "new digital deal", proposing to strengthen investment in information infrastructure and improve the level of informatization of small and medium-sized enterprises.

## 2 Problem Analysis and Research Model Construction

### 2.1 A Subsection Sample an Analysis Framework for the Influencing Factors of Digital Transformation of Automotive Enterprises

Based on the existing literature, contingency theory and high-echelon theory, this study uses the TOE theory analysis framework to condense and analyse the influencing factors of enterprise digital transformation.

**Technical Dimension.** The technology dimension includes digital technology, digital infrastructure, and data management capabilities. Combined with the existing literature and resource base, it can be concluded that digital technology is one of the most important factors to promote the digital transformation of enterprises, and the development of digital technology has promoted the optimisation of enterprise operation links and improved enterprise production efficiency [2]. However, the competitive advantage of enterprises does not lie in the digital technology itself, but in the ability of enterprises to develop and apply digital technologies. Although the construction and use of digital infrastructure can optimise enterprise business processes, improve management efficiency, and reduce enterprise production and operating costs, the construction of digital infrastructure can be imitated by other enterprises, so the management and use of digital infrastructure is the key to technological innovation and production efficiency [3]. The ability to manage enterprise data is crucial, and digital transformation will make data a factor of production and provide reference information for enterprise managers to make decisions, including the ability to process and analyse data such as production data and financial data in the production and operation process of enterprises, as well as the ability to build enterprise networks and break down information barriers between departments and factories, so as to serve enterprise decision-making[4]. Digital technology, digital infrastructure, and data management capabilities complement each other to create value for the enterprise.

**Organizational Dimensions.** Organizational factors include digital strategy and top management. Combining existing research with practice, it can be seen that digital strategy is the driving force of enterprise digital transformation[5], and business leaders also play an important role in digital transformation[6]. Developing an appropriate digital strategy can help companies coordinate resources and enhance competitiveness; On the contrary, the lack of a digital strategy can easily lead to waste of resources and poor

decision-making. Accenture's research data shows that the digital transformation of enterprises is mostly responsible for the company's senior leaders, and the ability of senior managers in combination with the top echelon theory is also an important factor driving the digital transformation of enterprises. Existing studies show that the education of senior managers has a certain impact on the digital transformation of enterprises. The digital transformation awareness of senior managers is the key to the digital transformation of enterprises, and the leadership of senior managers is also considered to be the primary factor for the success of enterprise digital transformation[7]. High-capable, high-awareness senior leaders can ensure the smooth implementation of enterprise digital transformation through a reasonable digital strategy and the maximum utilisation of the resources owned by the enterprise.

**Environmental Dimension.** The environmental dimension is market competition pressure and government support. Existing studies have shown that in the era of digital economy, the level of enterprise digitalisation can enable enterprises to take the lead in market competition, and can promote the digital transformation of enterprises when faced with pressure from competitors or cooperative enterprises due to digital development [8]. When enterprises face strong industry competition pressure and the degree of marketisation is low, the digital transformation of enterprises can promote the improvement of enterprise innovation efficiency. Although digital transformation is carried out by enterprises as individuals, due to the lack of unified reference cases or unified standards at this stage, it is easy to lead to unclear goals and lack of guidance in the process of enterprise digital transformation, and if there is a lack of external support, digital transformation will be very difficult. By reviewing the existing literature, it is found that government support is an important external driving force for enterprise digital transformation, and government support is an important factor for the success of enterprise digital transformation. Therefore, under the pressure of strong market competition, combined with the guidance and support of government policies, the digital transformation of enterprises will be carried out smoothly and effectively.

## 2.2 Construction of Configuration Model for Digital Transformation of Automotive Enterprises

QCA is an analysis method based on set theory, which explores the linkage mechanism of multiple antecedent variables on the results from the perspective of configuration. A review of the existing literature shows that the antecedents affecting the digital transformation of enterprises are complex and diverse, so it is necessary to analyse this behaviour through a qualitative comparative analysis method from a holistic perspective. In the qualitative comparative analysis method, the selected antecedent variables should be controlled between 4 and 7, and the more variables there are, the more variables will cause the configuration to be disperse. Based on the previous paper, this study condenses seven influencing factors from the three dimensions of technology, organisation, and environment: digital technology, digital infrastructure, data management capabilities, digital strategy, senior management, market competition pressure, and government

support. From the perspective of configuration, the impact of digital technology, digital infrastructure, data management capabilities, digital strategy, top management, market competition pressure and government support on the outcome (digital transformation of automotive enterprises) is interactive, and together shape the high-level results of digital transformation of automotive enterprises. Therefore, this study aims to study the linkage effect between the above seven factors and how they can be matched to each other to make automotive companies successfully carry out digital transformation. In this study, a configuration model of the influencing factors of digital transformation of automotive enterprises is proposed, as shown in Fig 1.

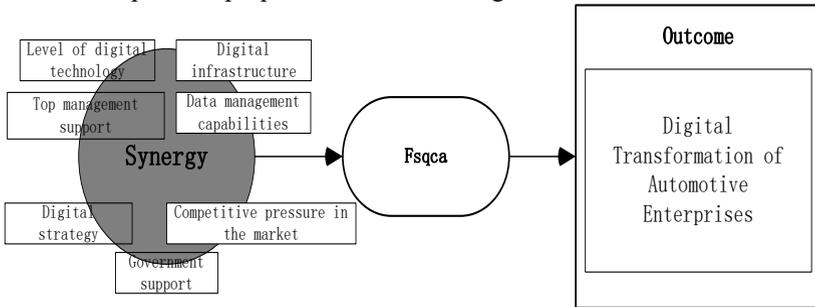


Fig. 1. Configuration model of digital transformation of automobile enterprise

### 3 Study Design

#### 3.1 Data Collection and Processing

A total of 153 questionnaires were distributed to automobile manufacturers who had already started digital transformation and achieved certain results, and 123 valid questionnaires were finally obtained after eliminating invalid questionnaires, with an effective recovery rate of 80.4%. The CA value of each variable was greater than 0.7 and the CR value was greater than 0.8, indicating that each variable had good internal consistency and the measurement model had good reliability. Through the calculation, the AVE is greater than 0.5 and the factor load is greater than 0.7, and the measurement model has good convergence validity.

In this study, the eight variables in the configuration model of the influencing factors of digitalisation of automobile enterprises were obtained through the Likert five-level scale, and the average score of each item of each of the eight variables was used as the variable score. After referring to the views of Fiss and taking into account the actual scores, the maximum and minimum values of the scores of each variable were set as the full membership threshold and the complete non-membership threshold. For variables where the mean and median scores differ little, the mean of the scores is set as the crossover threshold. The mean and median scores for some variables varied widely, with a median of 4.30 and a score of 4.30 for more than 20% of the total sample because the crossover threshold needed to be set at 4.29 or 4.31. If the intersection threshold of this part of the variable is set to 4.29, it will cause the calibrated data distribution to be skewed to the left, so the intersection threshold of this part of the variable is set to 4.31.

### 3.2 Experimental Results and Analysis

The consistency of the six configurations of digital transformation of automobile enterprises is relatively high, which are 0.977099, 0.96817, 0.965079, 0.96657, 0.973871 and 0.977, which interact with each other to explain the main reasons for the success of digital transformation of automobile enterprises. Digital infrastructure (DI) appears in each configuration as a core condition. This is shown in Table 1.

**Table 1.** Automotive enterprise digital transformation configuration

Conditional variables	Configuration of digital transformation of automotive enterprises					
	H1	H2	H3	H4	H5	H6
Level of digital technology	●	●	●	●	●	
Digital infrastructure	●	●		●	●	●
Data management capabilities	●		⊗	●	●	●
Digital Strategy	●	●	●	●		●
Top management		●	●	●	●	●
Competitive Pressure in the Market	●	●	●		●	●
Government Support			⊗	⊗	⊗	●
consistency	0.977099	0.96817	0.965079	0.96657	0.973871	0.977

Note: "●" indicates the core condition; "●" indicates an edge condition; "⊗" indicates that the core conditions are lacking;" ⊗"Indicates the absence of edge conditions;" "Blank" indicates that the configuration can be both present and absent.

In order to better identify the differences of different transition paths, this study is based on the logical characteristics of the above six configurations. Through the analysis of the above six configurations, it can be seen that digital infrastructure exists in each configuration as the core condition and edge condition, indicating that digital infrastructure construction is the basis for enterprises to achieve high-level digital transformation. Among them, the lack of government support in 5 groups as marginal conditions indicates that the current government support, guidance, and support for digital transformation are insufficient.

## 4 Conclusions

In this study, fsQCA is used to obtain six paths to promote the high-level digital transformation of automotive enterprises, among which digital infrastructure and senior management support, digital technology level, data management capability and market competition pressure are combined as the core conditions in six configurations. The results show that the construction of complete digital infrastructure, the improvement

of digital technology level, and the improvement of data management capabilities can bring efficiency and benefit improvement to enterprises, the pressure brought by market competition can effectively promote the digital transformation of enterprises, and the support of senior managers can get positive feedback from the digital transformation of enterprises, and the paths to produce unified results are diverse.

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