



# Research on the Digital Transformation Path of the Automotive Industry Driven by Big Data

## —Multi case analysis based on grounded theory

Danyu Zhu\*

Wuhan University of Technology, Wuhan, 430070, China

\*Corresponding author. email: 1991218289@qq.com

**Abstract.** The development of technology and the increase in demand are driving the digital transformation of China's automotive industry. Digital technology is fully integrated into the entire lifecycle operation system of automotive companies. Therefore, the Chinese automotive industry urgently needs to seek high-quality and efficient digital transformation paths. This article is based on the grounded theory to sort out and analyze the development paths of three typical new energy vehicle companies in China at different stages, and concludes that: firstly, big data drives the digital transformation of the automotive industry mainly through key link transformation and basic element empowerment to promote the optimization and restructuring of the automotive industry chain; Secondly, the transformation of key links is the core of promoting the optimization and reconstruction of the automotive industry chain, and the empowerment of basic elements provides basic resources for promoting the automotive industry chain; Thirdly, innovation in the value proposition of on chain enterprises includes strategic collaboration and resource sharing, both of which play an intermediary role in promoting the optimization and reconstruction of the automotive industry chain through big data technology, improving the efficiency of enterprise transformation.

**Keywords:** digital transformation; Transformation path; Rooted theory;

## 1 INTRODUCTION

New generation digital technologies such as big data, cloud computing, the Internet of Things, 5G, artificial intelligence, autonomous driving, and blockchain are rapidly integrating into the automotive industry, bringing profound changes to multiple aspects of the automotive industry, including research and development, design, manufacturing, and services. Digital technology is fully integrating into the entire lifecycle operation system of automotive companies, deeply reconstructing the automotive value chain and operation mode, and becoming an important driving force for driving business process reengineering and industrial chain reshaping in the automotive industry. Against the backdrop of declining profits, digitalization has become an important driving factor

for automotive industry enterprises to enhance their industry competitiveness. In addition, the constantly upgrading digital lifestyle of consumers and the increasing demand for innovative services have directly driven the digital transformation and upgrading of the automotive industry. As a culmination of manufacturing innovation, the automotive industry is at the forefront of the new round of digital technology revolution, and major automotive companies are seeking the path of digital transformation [1-2].

## **2 OVERVIEW OF THEORY AND RESEARCH METHODS**

### **2.1 Theoretical Overview**

Grounded Theory is a qualitative research approach that aims to establish theories based on empirical data, rather than describing phenomena or verifying theories, as theories always have stronger explanatory power than pure descriptions. Different from what Geertz (1973) called "deep drawing", grounded theory places more emphasis on the density of concepts, while "deep drawing" mainly focuses on the dense description of research phenomena at the descriptive level. Each concept in theory should have a systematic connection with other concepts. "Theory is a reasonable connection between concepts and a set of concepts," and each concept should be closely intertwined to form a unified and internally connected whole [3-4].

The term "digital transformation" was proposed by Coil. Currently, research on digital transformation abroad mainly focuses on organizational innovation, business model transformation, competitive advantage establishment, platform or business ecosystem construction, and other aspects. Ke Guanhong and Lv Hongfen [5] proposed practical problems such as reduced chip supply, difficulties in digital application of battery raw material production areas, and urgent need for digital transformation and upgrading of charging piles based on data related to new energy vehicles in China. Men Feng et al [6] analyzed four aspects: political environment, economic environment, social environment, and technological environment. They believe that although China has made significant progress in areas such as 5G and intelligent connected vehicles, and the gap between domestic and foreign brand products is becoming smaller, there are still a series of constraints and pressures such as technological barriers and market saturation.

### **2.2 Research Methods**

To ensure the reliability and validity of the study, following the principles of typicality and diversity in sample selection, as well as the availability of data, based on grounded theory, this paper selects three well-known domestic automotive companies, Chongqing Changan Automobile Co., Ltd. (referred to as Changan Automobile), BYD Co., Ltd. (referred to as BYD), and NIO Automobile Co., Ltd. (referred to as NIO), to conduct a study on the digital transformation process of the automotive industry and extract elements. In order to ensure the authenticity, richness and reliability of data materials, this paper collected a large number of first-hand data materials through semi-structured interviews with the main managers of three automobile enterprises and their suppliers, partners and consumers, and obtained a large number of second-hand data materials

through academic literature, enterprise public disclosure materials, industry reports, media reports, business review articles, micro blogs, WeChat official account tweets, Zhihu and video platforms. On this basis, data processing was carried out in chronological order and research topics, and the original data database was established to ensure the correctness and integrity of information.

### 3 DATA ANALYSIS AND MODEL CONSTRUCTION

#### 3.1 Open coding

Open coding refers to the process of encoding the collected raw text data paragraph by paragraph, sentence by sentence, and word by word, labeling the phenomena described in the raw data, and further conceptualizing and categorizing the labels. This article codes three automotive enterprise cases, extracts content related to the research topic from the original data, and forms corresponding initial categories. As shown in Table 1, a represents the labeling of the original data, aa is the preliminary organization of the labels, A represents conceptualization, and AA is the initial category formed. To ensure the reliability of the encoding results, this article uses Nvivo 12 software to encode the same data text until the concepts and categories are fully saturated.

**Table 1.** Open coding and results of digital transformation development path

Case	Research original data records	Conceptualization	Categorize
CHANGAN	The information technology industry has entered a stage of commercial profitability, and China's accession to the WTO and the opening up of the information industry are approaching. China's information technology industry, especially the network communication market, has enormous development potential in reality (a1). The Chinese government provides a favorable environment for the development of new energy vehicles, from the "Automobile Industry Development Policy", "New Energy Vehicle Production Access Management Rules", "Interim Measures for the Management of Financial Subsidies for Energy Conservation and New Energy Vehicle Demonstration and Promotion" to the soon to be released "Energy Conservation and New Energy Vehicle Industry Development Plan (2010-2020)" and a series of relevant policies issued by the government, which are sufficient to prove that the government takes practical actions(a2)	A1: External to-the enterprise	AA1:Enterprise-Resource AA2:Transforming entity AA3:Organizational-optimization
		A2: Internal to the enterprise	
		A3:Product-research and manufacturing	
		A4: Pre sales-service	
		A5: Talent reserve	
		A6:Strategic-partners	
		A7:Related-technologies	
		A8: Training system	
BYD			

NIO	<p>From the perspective of practical commercial interests, the benefits of investing in electric vehicles are also evident. With the continuous support of favorable policies for pure electric vehicles, the current booming market and potential market demand are guarantees for sustainable development in the future, and the technical difficulties are relatively easy to break through (a3).</p>	A9: After sales-service
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### 3.2 Spindle coding

Spindle coding refers to further linking the initial categories in open coding based on a certain logical paradigm, in order to establish potential connections between each category, as shown in Table 2.

**Table 2.** Optimal results of entity recognition experiment test set

Main Category	Main Category Connotation	Corresponding Category
Key-Link Transformation	Precision innovation based on the characteristics of the enterprise itself	Product development and manufacturing Related-technological innovation
Basic-Element Empowerment	Empowering multiple external and internal parties to accelerate the digital transformation of automotive companies	Talent Reserve and Training Positive government policies
Strategic Coordination	The process of collaborative achievement of common goals by enterprises based on a shared value proposition	Consistent enterprise goals Strategic partners
Rsource-Sharing	Automobile companies integrate and collaborate resources to build a new industrial chain	Integrate the production capacity of leading enterprises Resource sharing between enterprises
Industrial-chain reconstruction	Reshaping the post automotive industry chain	Automotive aftermarket services Extension of industrial chain

### 3.3 Selective encoding

Selective encoding refers to discovering the core category from the main category and surrounding it to derive the relationships between different categories in the form of storylines. Through continuous dialogue between literature and textual materials until no new connections are identified, the core category of this study is extracted as big

data driving the digital transformation of the automotive industry, as shown in Figure 1.

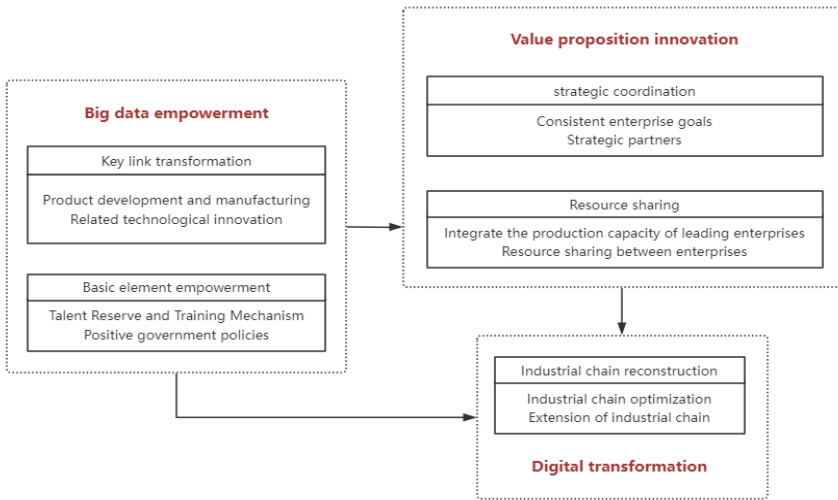


Fig. 1. Selective coding and results of digital transformation development path

### 3.4 Theoretical saturation test

Theoretical saturation refers to the absence of new concepts and categories when re encoding additional relevant data. This article will import the reserved three second-hand materials into Nvivo 12 for re coding, and no new concepts or categories have emerged. The coding results are basically consistent with the impact mechanism model of empowering government behavior on industrial chain construction. This indicates that the theoretical framework constructed in this article has passed the theoretical saturation test and has certain practical explanatory-power.

## 4 CASE ANALYSIS AND DISCUSSION

By analyzing case data of digital transformation driven by big data in the automotive industry, the empowering behavior of big data in promoting the restructuring of the automotive industry chain was clarified, and it was found from the case data that enterprise collaboration models play an important role. BYD has developed new energy vehicles through its own technological accumulation and research and development of battery systems, standing out in the market with uneven quality and high failure rates of domestically produced cars. At the beginning of its official establishment, NIO established a global high-end electric vehicle brand strategy. Basic element empowerment refers to the empowerment of multiple external and internal factors to accelerate the digital transformation of automotive enterprises, including talent reserves and training

mechanisms, as well as favorable government policies, providing basic resources for promoting the automotive industry chain. "Digital transformation" is the key to Changan Automobile's transformation from a traditional manufacturing enterprise to a technology company.

## 5 CONCLUSIONS

### 5.1 Research Conclusion

Based on existing research, this article uses big data technology and standardized grounded theory coding techniques. Through multiple case studies, it is found that: firstly, the development path of digital transformation driven by big data in the automotive industry mainly promotes the optimization and reconstruction of the automotive industry chain through key link transformation and basic element empowerment. Among them, the transformation of key links includes product research and development, manufacturing, and related technological innovation; The empowerment of basic elements includes talent reserves and training mechanisms, as well as favorable government policies. Secondly, the transformation of key links is the core of promoting the optimization and reconstruction of the automotive industry chain, and the empowerment of basic elements provides basic resources for promoting the automotive industry chain. Finally, innovation in the value proposition of on chain enterprises includes strategic collaboration and resource sharing, both of which play an intermediary role in promoting the optimization and reconstruction of the automotive industry chain through big data technology, improving the efficiency of enterprise transformation.

### 5.2 Suggestions

Based on the above conclusions, this article proposes the following policy recommendations:

The government needs to accurately identify the foundation of the automotive industry and provide strategic support from the perspective of industry chain construction. Local governments need to accurately identify the foundation of the automotive industry, adhere to market orientation and enterprise entities, comply with market development laws, choose digital transformation enterprises with their own advantages for strategic support, and also support new energy vehicle enterprises that have important impacts on national economic security and future development.

## REFERENCES

1. Wu Jiehui.(2023)The application and prospect analysis of big data technology in 5G network communication.J, China High tech: 139-141.DOI: 10.13535/j.cnki.10-1507/n.2023.10.49

2. Wang Hejia.(2022) Ten Years of Intelligent Manufacturing: Deep Integration of Big Data, Cloud Computing, and Traditional Industry.J, Communication World: 20-21.DOI: 10.13571/j.cnki.cww.2022.18.003
3. Jia Xudong.(2020) measure The Jungle, Past, and Approach of Rooted.J, Theory Research Management: 151-163.DOI: 10.19571/j.cnki.1000-2995.2020.05.016
4. Jia Xudong.(2010) Research on Public Service Outsourcing of Grassroots Government in Chinese Cities Based on Rooted Theory .D. Lanzhou University, 2010
5. Ke Guanhong.(2023) Lv Hongfen. Research on the Transformation and Upgrading of the New Energy Vehicle Industry under the Background of Digital Economy.J, Northern Economics, : 51-54
6. Men Feng, Wu Rui, Dong Fangqi, Liang Lijun.(2022) PEST analysis and countermeasures for digital transformation of automotive enterprises.J, Automotive Practical Technology: 183-190. DOI: 10.16638/j.cnki.1671-7988.2022.024.034

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