



Business Model Innovation Driven by Artificial Intelligence

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Abstract. With the continuous development of artificial intelligence, its role in promoting business model innovation has become more and more obvious. This article focuses on the in-depth discussion of artificial intelligence-driven business model innovation, and proposes a comprehensive theoretical framework to reveal how companies can achieve systematic transformation and optimization of business models driven by artificial intelligence. This paper proposes a theoretical framework of business model innovation including four main building blocks, and analyzes the actual case of business model innovation after the enterprise adopts artificial intelligence technology, reveals how the intelligent platform can help enterprises realize accurate prediction of customer demand, intelligent collaboration of supply chain and rapid iteration of new products and services. Finally, this article looks forward to the future development trends and challenges of artificial intelligence business model innovation, and puts forward relevant policy recommendations and corporate strategic guidance, which is of strategic significance for understanding corporate competition and collaboration in the future business environment.

Keywords: artificial intelligence; Business model innovation; Data-driven; Algorithm optimization; Intelligent Service Ecosystem

1 Introduction

With the continuous advancement of artificial intelligence technology, its application in the business field is also expanding, bringing new opportunities and challenges for enterprises to innovate business models. Artificial intelligence is profoundly affecting the business operation methods of enterprises, promoting the innovation of business models of enterprises, and reshaping the path of enterprise value creation and value acquisition^[1] ^[2]. Research has found that AI-driven business model innovation can help companies gain a sustainable competitive advantage. In the context of increasing environmental uncertainty, artificial intelligence can help companies respond more sensitively to market changes, while improving the quality of decision-making through data-driven insights, promoting organizational learning and knowledge innovation, and accelerating the dynamic optimization and innovation of business models^[2]. From the perspective of AI technology driving factors and business model innova-

tion theory, this paper analyzes the typical path and mode of artificial intelligence reshaping enterprise business model, looks forward to the application prospect of artificial intelligence in business model innovation, and provides theoretical guidance and practical reference for enterprises to grasp the strategic opportunities brought by AI technology revolution.

2 The Commercial Application of Artificial Intelligence

2.1 Business Model Innovation Theory

Business model innovation is a brand-new systematic method for companies to create value and obtain profits. It reshapes the value proposition, value creation and value acquisition methods of the enterprise, reconfigures the core elements of the enterprise and their interrelationships, and forms a unique and difficult to imitate competitive advantage^[3]. In recent years, with the rapid development of AI technology, AI has shown great potential in promoting business model innovation. Through automation, intelligence and personalization, AI has profoundly affected the business model, product service and customer relationship of enterprises, providing new ideas and means for business model innovation^[4].

From the perspective of value proposition, AI can help companies develop more intelligent and personalized products and services, and improve customer experience and satisfaction. For example, the unmanned convenience store developed by JD.com using computer vision technology is a typical case of using AI technology to enhance the value of products and services. From the perspective of value creation, AI technology can optimize the business process of an enterprise and improve operational efficiency and productivity^[2]. For example, Foxconn's introduction of industrial robots to automate production lines, and Haier's use of artificial intelligence to optimize supply chain management are all successful practices of using AI technology to enhance value creation capabilities. From the perspective of value acquisition, AI technology can help companies develop new profit models and sources of income. For example, Baidu uses AI technology to provide enterprises with intelligent marketing solutions to achieve the precision and personalization of advertising, thereby obtaining higher advertising revenue^[2].

2.2 Analysis of Driving Factors of AI Technology

The driving force of technological development is an important factor driving the innovation of AI business models. In recent years, AI-related basic technologies such as sensors, the Internet of Things, and high-performance chips have developed rapidly, providing key support for building a new AI-driven business model^[5]. At the same time, core technologies such as machine learning and deep learning have made major breakthroughs in processing massive amounts of complex data and performing intelligent predictive analysis, enabling AI systems to have more powerful perception capabilities and to achieve more personalized and accurate services in business scenarios^[6]. In addition, technology integration and innovation are also important drivers

for AI to reshape business models. If AI is combined with blockchain technology, a more secure, transparent, decentralized trust mechanism and value exchange network can be established, which will help the emergence of new models such as supply chain finance and smart contracts^[5].

Demand traction is another driving force for the innovation of AI business models. As users' expectations for service quality and experience continue to increase, companies urgently need to use AI to gain insight into user needs, optimize business processes, and provide differentiated smart products^[5]. For example, e-commerce platforms use AI algorithms to implement intelligent recommendations and dynamic pricing to match consumers' personalized preferences; Manufacturing companies use AI predictive maintenance to improve equipment reliability and production efficiency, and better meet customized production needs^[7]. AI-driven demand response capabilities have become a key element of an enterprise's core competitiveness.

3 AI Business Model Innovation Framework

3.1 Theoretical Construction Method

This article takes artificial intelligence as the driving force and deeply discusses the internal mechanism and dynamic process of business model innovation. This article defines the research field and scope of AI business model innovation, and aims to form an initial idea as the cornerstone of the development of the theoretical framework. Then, it collected data including but not limited to in-depth interviews, case studies and second-hand data. At the same time, it introduced the flow chart of AI business model innovation theory construction, and set a clear research path and plan. This paper uses statistical methods and machine learning techniques to test the validity of the constructed theoretical model to ensure that the proposed theoretical framework not only has academic value, but can also be applied in practice, theory construction are shown in figure 1.

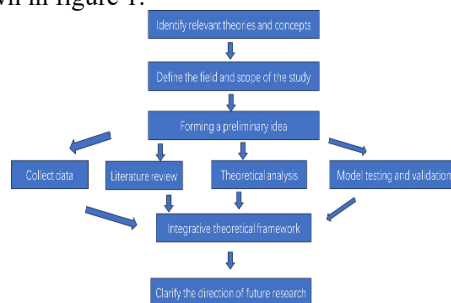


Fig. 1. Flow chart of AI business model innovation theory construction

3.2 Framework Function and Value

In the process of constructing an artificial intelligence business model innovation framework, this article systematically analyzes the role and transformation mecha-

nism of AI technology in the business model, and extracts the core elements of innovation. By comparing and analyzing the differences between traditional business models and AI-driven business models, this paper identifies the critical path of intelligent transformation and its dual impact on value creation and value capture. The research uses a structured topic model to extract the topic distribution in the literature, and uses principal component analysis to verify the rationality and coverage of the AI-BMI framework. At the same time, according to the business model canvas methodology, the architecture of AI business model innovation has been further refined, which combines the decision-making logic of big data analysis and the pattern recognition ability of machine learning.

We analyze a cross-industry data set covering 500 companies, use multiple regression models and random forest algorithms in machine learning to effectively identify the business value of data-driven decision-making, and try to portray the development of future intelligent business models. Through this method, we can extract the AI application scenarios and solutions that best reflect value innovation in the business model, and infer their potential impact on the efficiency of business operations. In the value creation dimension under the AI-BMI framework, this article finds that value chain automation, consumer experience personalization and data-driven strategic decision-making will become the areas with the most transformative potential.

In the big data environment, this article has conducted an in-depth discussion on the theoretical construction of AI business model, and systematically explained the challenge and reshaping of traditional business logic by AI business model innovation. In the process of verifying the scientificity and practicability of the AI-BMI framework, cross-validation and sensitivity analysis were used to ensure the reliability and universality of the results.

4 Empirical Research and Case Study

4.1 Data Selection and Processing Methods

Focusing on different dimensions of business activities and their economic effects, this paper strictly screens economic indicator data, user behavior data, financial market data, social media data and consumer questionnaire data from national databases, financial institutions, social platforms, market surveys, and smart devices, and constructs a detailed "statistical table for data selection and processing".

In order to realize the scientific analysis and processing of data, this paper adopts Python as the main language of data processing, and uses its powerful Pandas and NumPy library for data cleaning and preprocessing. For example, when performing data cleaning, KNN interpolation, median filling and other multivariate strategies are used to deal with vacant values, and outliers are eliminated by 3σ criterion and IQR method to ensure the accuracy of data analysis. At the same time, for different data characteristics, a variety of standardization methods such as Z-score, Min-Max, MaxAbs, L2 norm, etc. are used to ensure the unity and comparability of the data before entering the model training. In addition, for special types of data, such as social media text preprocessing, a highly customized text processing method is adopted.

In particular, when the data sets were randomly composed, the study ensured that the experimental groups of each data set showed structural homogeneity with the overall data set, and were divided according to the ratio of the training set to the test set specified in the table to meet the needs of the model training and verification process. The diversity of experimental group settings also provides a guarantee for the rigor and wide applicability of the research, data selection and processing are shown in Table 1.

In summary, through precise selection and meticulous processing of the data required for business model innovation, combined with scientific statistical methods, this study ensures the credibility of the data analysis results and the strength of the empirical research arguments.

Table 1. Statistics on data selection and processing

data type	Experimental group	Amount of data	Data source	Pretreatment method	Missing value handling	Outlier handling	Data normalization methods	Proportion of the training set	Proportion of test sets
Economic indicator data	Group A	5000	National databases	Data cleansing	Median filling	3 σ criterion reject	Z-score standardization	70%	30%
User Behavior Data	Group B	8000	Corporate Collaboration	Data Conversion	KNN imputation	IQR method culling	Min-Max standardization	60%	40%
Financial market data	Group C	3500	financial institution	Imputation of missing values	Mean padding	Box plot culling	MaxAbs standardized	80%	20%
Social Media Data	Group D	50000	Social platforms	Text preprocessing	Deletion processing	Rule method exclusion	L2 norm standardization	75%	25%
Consumer questionnaire data	Group E	1500	market research	Encoding conversion	Regression imputation	Threshold method reject	Nonlinear standardization	65%	35%

4.2 Typical Case Analysis and Discussion

Today, when artificial intelligence technology is becoming more and more mature, its application in business model innovation has gradually become a research hotspot. By constructing a theoretical framework, this article aims to explore how AI technology can bring value to enterprises, and conduct an in-depth discussion on this issue in the form of empirical research and case analysis. Using a value quantification approach, we introduced the AI technology value quantification formula:

$$V(AI) = \int_0^T \frac{\Delta CF_t}{(1+r)^t} dt \quad (1)$$

Among them, ΔCF_t represents the incremental cash flow brought by AI technology, r is the capital cost of the enterprise, and T is the forecast period. Through this

formula, we can accurately estimate the marginal value brought by AI technology from a financial perspective.

For empirical research, this article selects typical cross-industry companies as the research object, using mixed research methods, combining qualitative analysis and quantitative analysis to ensure the comprehensiveness and accuracy of the results. Starting from the four-dimensional composition of business model, namely value creation, value delivery, value capture and value communication, this paper first analyzes the existing business model of enterprises, and then analyzes the influence of AI technology intervention on the constituent elements. In addition, this paper uses a structural equation model to test the relationship between AI technology and the various components of the business model to ensure the scientific and logical conclusions of the research.

In the case analysis part, this article records the change trajectory of the business model of the enterprise and the improvement of economic benefits before and after the intervention of AI technology. In order to ensure the breadth and depth of the case analysis, this article selects various types of enterprises including start-ups and mature enterprises for in-depth analysis. With the help of big data analysis tools, the actual application effect of AI technology and the simulation prediction results are compared and analyzed, which reveals the enhancement effect of AI technology on the competitiveness of enterprises.

Combining the results of theoretical analysis and empirical research, this article provides a clear guiding framework for how companies use AI technology to innovate business models in a constantly changing business environment. Through in-depth analysis and learning of successful cases, other companies can use this to understand the true value of AI technology and occupy a favorable position in future competition.

5 Conclusion

Artificial intelligence is becoming an important force to promote business model innovation. By constructing the theoretical framework of AI business model innovation, this paper clarifies how artificial intelligence technology can help enterprises realize the systematic change of business model by optimizing the value proposition, value creation and transmission, and value acquisition of enterprises[8][9]. Empirical cases further support the application value of the framework, revealing the unique advantages of artificial intelligence in personalized user services, intelligent operation management, and data-driven decision-making [8].

However, AI-driven business model innovation still faces many challenges. Enterprises need to increase investment in data governance[10], algorithm ethics, talent training, etc., while focusing on the shaping of innovative culture. In the future, with the continuous progress of artificial intelligence technology[11], its application in the commercial field will be more extensive and in-depth. There are still some limitations in the research of this paper. For example, the representativeness of case selection needs to be improved, and the time span of empirical data is relatively short. Subsequent research can further expand the sample size, adopt more diverse

data sources and analysis methods, and deepen the exploration of the law of AI business model innovation[12].At the same time, the application effect of artificial intelligence in specific industries and scenarios is also worthy of further investigation[13][14].Through continuous theoretical innovation and practical exploration, it will surely promote the deep integration of artificial intelligence and business[15], and create a new situation of intelligent economy.

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