

Research Article

A Study on the Influencing Factors and Perceived Value Role of Big Data Analytics Adoption by Chinese Main Board Listed Companies under the TOE Framework: Literature Review and Future Research Prospects

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Abstract

Against the backdrop of rapid development in the digital economy, big data analytics has become a core digital tool for enterprises to optimize operations, integrate supply chain resources, and build market competitive advantages. Domestic main board listed companies, with their complete governance systems, stable cash flow, and diversified business scenarios, are the core entities for big data application. However, big data adoption is constrained by multiple factors including technology, organization, and environment. Perceived value, as the core subjective judgment standard for management's digital decision-making, plays a crucial mediating role in the transmission between various TOE (Technology-Organization-Environment) elements and corporate big data investment behavior. This paper employs an integrative literature review method, using the TOE framework as a unified analytical lens, to sort out various antecedent factors of big data adoption in existing research, clarify the internal transmission logic of perceived value, summarize existing research conclusions, generalize the limitations of current research and propose future research directions. The results show that existing empirical studies mostly focus on sub-sectors such as fisheries, cultural tourism, port and shipping, and specialized and innovative industries, lacking an integrated review of all categories of main board listed companies. This leads to shortcomings such as industry segmentation, neglect of the unique institutional characteristics of main board companies, and insufficient empirical evidence on the perceived transmission mechanism. The relevant conclusions can provide theoretical support for the digital strategic layout of listed companies and the formulation of government digital industry policies.

Keywords

TOE framework, Big data analytics adoption, Perceived value, Main board listed companies, Integrative

1. Introduction

With ongoing global supply chain disruptions and increasingly diversified market demands, digital technologies have become a crucial tool for enterprises to mitigate operational uncertainties. Big data analytics, relying on massive information processing, demand forecasting, and end-to-end collaboration capabilities, has become a core vehicle for digital transformation of various enterprises (Sharma et al., 2023). Since the implementation of the “Internet+” policy series in China, the digitalization process across various industries has accelerated. As the backbone of the national economy, main board listed companies possess sufficient funds, a well-established industrial chain layout, and standardized information disclosure mechanisms, making them the core carriers for big data technology implementation (Liu et al., 2020). However, in practice, enterprises generally face challenges such as significant divergence in willingness to invest in big data and low efficiency in data asset utilization. Whether an enterprise chooses to deploy big data analytics is not determined by a single factor, but rather by a complex interplay of technological endowments, internal organizational resources, and the external market policy environment (Jin & Guo, 2025).

Existing empirical studies show significant divergence in selected industry samples. In the fisheries sector, research relies on panel data from listed companies to verify the positive impact of digital transformation on supply chain efficiency (Zhang et al., 2025). In the cultural and tourism industry, research uses multi-criteria models to rank key influencing factors based on industry expert survey data (Sharma et al., 2023). In the port and shipping sector, machine learning algorithms are used to uncover the nonlinear driving factors of digital transformation (Jin & Guo, 2025). Specialized and innovative listed companies use the fsQCA (fuzzy-set Qualitative Comparative Analysis) method to identify diverse configuration paths for digital empowerment of high-quality enterprise development (Zhang et al., 2024). However, existing research still has notable shortcomings: First, research samples are limited to single sub-sectors, lacking an integrated literature review covering all main board listed companies, making it difficult to form universal conclusions; Second, most studies only examine the direct effects of technology, organization, and environmental factors, ignoring the mediating transmission effect of perceived value as a management subjective cognitive variable, and failing to explain how objective conditions are transformed into digital investment decisions (Y. Wang et al., 2024); Third, various empirical tools are used in a scattered manner, lacking a systematic comparison of applicable scenarios and pros and cons

of different econometric, configurational, and machine learning methods. Based on the above research gaps, this paper conducts an integrative literature review, unifying existing research results under the TOE framework, extracting shortcomings of current studies and proposing feasible future research directions, addressing the industry fragmentation and neglect of subjective perception mechanisms, and providing theoretical reference for big data strategic planning and digital industry policy formulation of domestic main board listed companies.(Huang et al., 2024)

The TOE (Technology-Organization-Environment) framework, proposed by Tornatzky and Fleischer (1990), is the core theoretical support of this paper. This theory divides the influencing factors of enterprises' new technology adoption into three dimensions: technology, organization, and environment. The technology dimension focuses on the enterprise's own digital infrastructure, data resources, and technology costs; the organization dimension covers the enterprise's governance structure, talent reserves, financial strength, and management philosophy; the environment dimension includes external conditions such as industry competition, government policies, and supply chain external pressure. It can comprehensively consider both internal resources and external constraints of enterprises. Compared with single-perspective theories such as TAM (Technology Acceptance Model) and MOA (Motivation-Opportunity-Ability), it is more suitable for analyzing asset-heavy and full-chain digital behaviors such as big data adoption (Sharma et al., 2023; Jin & Guo, 2025).

2. Methods

This paper employs an integrative literature review approach, with core work revolving around three main areas: comprehensive reading, categorized comparison, and theoretical integration. A horizontal comparative analysis is conducted, unifying research variables scattered across different industries such as fisheries, cultural tourism, port and shipping, and specialized and innovative industries into the three dimensions of the TOE framework: technology, organization, and environment. Core influencing factors with cross-industry applicability are extracted from each dimension. Variables in existing studies with connotations similar to perceived value are identified and integrated, to form a complete theoretical transmission logic of "TOE objective conditions—perceived value—big data adoption". It should be noted that the mediating role of perceived value summarized in this paper is a theoretical proposition derived from literature integration, which needs further empirical verification in follow-up research.

3. Results

First, existing research samples exhibit highly segmented industry characteristics, lacking a comprehensive study covering all main board listed companies across the entire industry. Fishery-related research uses panel data from 2015 to 2021 from nine A-share listed fishery companies to explore the impact of digital transformation on supply chain efficiency (Zhang et al., 2025); the cultural tourism industry relies on interview data from 28 industry experts to identify priority influencing factors for big data implementation; the German enterprise survey sample uses questionnaires from small-scale enterprises and combines dynamic capability theory to analyze internal driving conditions for big data adoption; the specialized and innovative research selects a sample of 141 national-level listed “little giant” enterprises to explore configuration combinations of digital empowerment for high-quality development (Zhang et al., 2024); the port and shipping industry uses panel data from 83 A-share listed port and shipping companies over 15 years to analyze driving factors of digital transformation with nonlinear models (Jin & Guo, 2025). All these studies are limited to single industry sectors and lack a holistic analysis that incorporates the unified regulatory, disclosure, and equity systems of main board listed companies.(M. Wang & Zhang, 2024;Wang et al., 2024)

Second, by integrating variables from various literature sources under the TOE framework, cross-industry common core factors and industry-specific variables can be distinguished. At the technology level, the degree of digital transformation is a common core variable in all listed company studies, generally measured by using Python word segmentation to extract the frequency of keywords such as big data, artificial intelligence, and blockchain from annual reports. Data quality is listed as the primary influencing factor in cultural tourism research; low-quality data significantly increases the cost of big data implementation and reduces enterprises’ willingness to invest. Internal and external data reserves, digital infrastructure, and technology implementation costs are common cross-industry constraints. At the organizational level, support from senior management is a core positive factor agreed upon in all literature. Insufficient digital professional talent reserves are a common cross-industry constraint. Company size, total assets, R&D investment, equity nature, management shareholding, percentage of independent directors, and organizational innovation culture are all common organizational variables. Common environmental factors include industry competitive pressure, government digital support policies, and pressure for collaboration between upstream and downstream industries. External competition will push enterprises to deploy big data to maintain competitive advantages, and various industry subsidies can lower the threshold for digital investment. The port and shipping industry has a unique environmental variable of green and inclusive finance; regional financial support can

alleviate digital financing constraints for enterprises. ESG (Environmental, Social, and Governance) regulatory requirements and the regional business environment are also important external influencing factors.(L. Wang et al., 2018)

Third, integrating common variables from the literature can clarify the theoretical mediating transmission path of perceived value. While many studies do not directly use the variable “perceived value”, they set indicators with highly overlapping connotations. Predictive accuracy and perceived cost in cultural tourism research, and perceived usefulness and perceived ease of use under the MOA framework, are all dimensions constituting perceived value(Verma&Bhattacharyya, 2017). The analytical logic of existing literature can be uniformly summarized as follows: an enterprise’s own technological resources, internal organizational strength, and external policy and competitive environment are objective preconditions. These factors do not directly affect big data investment behavior, but will first influence management’s comprehensive subjective judgment of big data benefits, implementation costs, and potential risks—that is, perceived value. If management perceives that big data can create higher operating returns and that investment costs are controllable, it will increase their willingness to adopt big data. Most existing literature only conducts theoretical deductions on this path and lacks normative empirical testing of the mediating effect.

Fourth, the empirical tools used in existing research can be divided into four main categories, each with distinct advantages and limitations. First, traditional linear panel models, including fixed effects, LASSO, and Ridge regression, can quantify the independent impact of a single variable and conduct multiple robustness tests, but the linear assumption cannot capture multivariate synergistic and nonlinear interaction effects. Second, fsQCA can identify multiple equivalent driving configurations, distinguish between core and marginal conditions, and is suitable for complex causal analysis, but it cannot output quantitative impact coefficients and has high requirements for data calibration. Third, the DEMATEL (Decision Making Trial and Evaluation Laboratory) multi-criteria decision model combined with AHP (Analytic Hierarchy Process), relying on expert data, can distinguish causal relationships between variables and complete weight ranking, but subjective scoring introduces bias and is not suitable for long-panel financial data of listed companies. Fourth, gradient boosting machine learning models such as XGBoost and LightGBM can automatically uncover higher-order interactions and nonlinear relationships, resulting in higher model fit, but they suffer from black-box problems and are difficult to apply to mechanism transmission testing.

4. Discussion

Existing literature on big data adoption based on the TOE framework has rich theoretical value, expanding the research boundaries of the digital transformation field from multiple dimensions. The parallel application of multiple empirical methods, including linear, configurational, and machine learning approaches, enriches the empirical toolbox for digitalization research. Linear models are suitable for identifying the net effect of a single variable, fsQCA can uncover multiple equivalent driving paths, and machine learning excels at capturing complex nonlinear relationships. The applicable scenarios for different methods have been clearly distinguished in existing studies, providing a reference for subsequent empirical design.

Existing research has preliminarily outlined the transmission logic of perceived value. Although direct mediation tests are lacking, the analysis results of various homologous variables form a unified theoretical chain, supplementing the intermediate mechanism of “objective conditions to corporate behavior” in the TOE framework and making up for the shortcoming of the original TOE theory that only focuses on antecedents and ignores subjective cognitive mediation. Meanwhile, industry-specific studies have also uncovered industry-specific variables, such as green finance in the port and shipping industry and digitalization demands of the fisheries supply chain, providing differentiated analytical perspectives for digitalization research in specific fields.

Overall, the current literature system has four core deficiencies, which are also gaps that need to be filled in future research. First, sample selection is noticeably limited. Existing studies all focus on single sub-sectors, lacking a holistic analysis covering all main board listed companies. The unified listing regulations, information disclosure, and equity governance rules of main board companies are not included in the analysis, making it difficult to cross-reference conclusions on influencing factors from different industries and failing to form universally applicable research conclusions. Second, empirical evidence on the mediating mechanism of perceived value is insufficient. Most literature only theoretically infers how objective conditions influence digital decision-making through subjective perception, without constructing standardized measurement indicators for perceived value or conducting quantitative tests on mediating effects and configurational mediation. The theoretical logic lacks empirical data support, making it impossible to clearly demonstrate transmission strength and differentiated paths. Third, the empirical methods used are relatively singular. Most studies select only one model for analysis, failing to achieve complementary verification of linear net effects, configurational paths, and nonlinear interactions, resulting in limited persuasiveness of research conclusions. For example, linear regression can only identify the significance of a single variable and cannot explain how

multiple factors work together to promote big data adoption, while fsQCA cannot quantify the magnitude of each factor's influence. Fourth, the heterogeneity of main board listed companies is ignored. Existing research fails to differentiate between state-owned and private enterprises, high-R&D and low-R&D enterprises, and enterprises at different positions in the industrial chain in terms of big data adoption and perceived value, making it difficult to explain the inherent differences in digital behavior of different types of main board companies.

Finally, existing literature provides dual practical insights for enterprise operation and policy formulation. At the enterprise level, main board listed companies cannot rely solely on financial investment to deploy big data; they need to simultaneously optimize three key dimensions: technology, organization, and environment. On the one hand, they must improve internal data resources and digital talent reserves, optimize management's understanding of digital strategy, and enhance their perception of the expected benefits of big data. On the other hand, they must proactively adapt to industry digital competition trends, align with government digital support policies, reduce digital investment costs, improve management's perceived value, and thus increase willingness to implement big data. At the policy level, the government should implement tiered policies when formulating digital industry policies, offering differentiated support programs for main board companies in different industries. These programs should cover financial subsidies, digital talent support, and data platform construction, while also improving green finance and supporting services for industrial digitalization. This optimized external environment will improve enterprises' perception of digitalization value and promote the widespread application of big data across all industries.

5. Conclusions

This paper adopts an integrative literature review approach, based on existing studies on digitalization and big data adoption, and sorts out various influencing factors of big data adoption by Chinese main board listed companies under the TOE framework. It elucidates the theoretical mediating role of perceived value in digital decision-making, summarizes the samples, variables, empirical methods and existing shortcomings of current research, and draws the following core conclusions.

First, enterprises' big data adoption behavior is jointly determined by three objective conditions: technology, organization, and environment. Digital infrastructure and data quality in the technology dimension, management support and digital talent in the organization dimension, and industry competition and industrial policies in the environment dimension are core cross-industry driving factors. Meanwhile, there are unique influencing variables in

sub-sectors such as port and shipping and fisheries, such as green finance and supply chain digitalization. These factors do not work alone and need to be combined synergistically to drive enterprises' big data investment.

Second, perceived value is a key intermediary connecting TOE objective factors with big data adoption behavior. Various conditions at the technical, organizational, and environmental levels do not directly change corporate digitalization decisions, but rather influence enterprises' willingness to deploy big data by adjusting management's comprehensive subjective judgment on the benefits, costs, and risks of big data. Existing research has only completed theoretical deduction on this transmission mechanism and lacks standardized empirical test support.

Third, current research samples are highly segmented, only covering single industries such as fisheries, cultural tourism, port and shipping, and specialized and innovative industries, lacking integrated research covering all categories of main board listed companies. Empirical methods are divided into four categories: traditional linear regression, fsQCA, DEMATEL, and machine learning, each with its own advantages and limitations, and single models have obvious shortcomings, so composite model design is the direction of future research optimization.

Based on the above research gaps, three feasible future research directions are proposed. First, broaden the research sample by selecting panel data of all main board listed companies across industries. Use annual report word frequency and financial indicators to uniformly measure digitalization level and perceived value, and conduct heterogeneity analysis incorporating unique systems such as listing supervision and equity governance, to extract universally applicable research conclusions. Second, improve mechanism testing by constructing standardized perceived value measurement indicators, and using mediation effect models and fsQCA configurational mediation tests to quantify the transmission strength of TOE elements influencing big data adoption through perceived value, so as to strengthen the empirical support for the theoretical mechanism. Third, adopt a composite empirical design, combining fixed-effects regression to identify net effects, fsQCA to uncover multiple driving paths, and machine learning to test nonlinear interactions. Multiple methods should be used to mutually corroborate each other, enhancing the robustness and explanatory power of the conclusions.

Acknowledgments

Not applicable.

Author contributions

Not applicable.

Funding

Not applicable.

Data availability

No datasets were generated or analysed during the current study.

Declarations

Conflict of interest

The authors declare that there is no conflict of interest.

Ethics approval

Not applicable.

Consent to participate

Not applicable.

Consent for publication

All authors have given their consent.

Additional information

Received: 6 July 2026

Accepted: 31 July 2026

Published online: 28 August 2026

Publisher's Note

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