



Digital Transformation and Intelligent Decision-Making: Enhancing Efficiency in Platform Company through TOE Framework

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Abstract. In the digital economy era, emerging technologies and business models provide opportunities for enterprises to achieve intelligent and scientific decision-making. Intelligent decision-making is not only a trend but also critical for enterprises to adapt to complex business environments and enhance competitiveness. However, many enterprises face challenges in implementing intelligent decision-making. This study explores these challenges and proposes strategies using a theoretical model and empirical analysis. Focusing on government platform company (ShuDao Group), the research finds that digital transformation can improve decision-making efficiency by helping managers better understand market dynamics, assess risks, and track execution. Using the TOE framework, this study analyzes how technological, organizational, and environmental factors influence intelligent decision-making. Results show that artificial intelligence's advantages significantly enhance decision-making efficiency, while management support and external pressures also play key roles. However, challenges like technological complexity and security risks persist. This study enriches the application of technology theories in decision-making and offers practical guidance for enterprises undergoing digital transformation.

Keywords: Management Decision-Making, Artificial Intelligence, Technology Diffusion, TOE Framework

1 Introduction

AI and digital tech advancements drive firms to adopt intelligent decision-making systems. Using the TOE framework, this study on Shudao Group explores AI adoption factors, highlighting challenges and offering theoretical/practical insights. Employing the Technology–Organization–Environment (TOE) framework [1], which is subsequently validated across numerous technology adoption studies, the investigation delves into the intricate interplay of factors that either catalyze or impede the integration of intelligent decision-making systems. Further, studies have accentuated AI's pivotal role in fostering innovation and securing competitive advantage [2].

2 Company Background and AI-Driven Decision-Making Practice

2.1 Company Overview

Shudao Group, a 2017-founded Sichuan municipal-funded state-owned enterprise with AAA rating, operates in 4 sectors. Complex governance and data integration issues hinder its decision-making. However, its complex governance structure and lack of data integration have posed significant challenges to strategic coordination and decision-making efficiency [3].

2.2 Background of Digital Transformation

By integrating digital tools into its operations, Shudao Group seeks to break down information silos between subsidiaries, streamline workflows, and create a unified intelligent management platform that aligns with its strategic goals of sustainable development and operational excellence [4].

2.3 Key Modules of AI-Driven Decision-Making

Shudao Group's AI-driven strategy centers on three modules to boost decision efficiency. It uses advanced systems with AI for real-time data analytics, builds a unified data platform for seamless info flow, and reengineers processes with AI to automate tasks, reduce cycles, and allocate resources efficiently.

3 Literature Review

In the digital economy, integrating AI into corporate decision-making is key. This review, using TOE, explores AI's impact, drivers, and challenges in management. This literature review aims to synthesize existing research on the application of AI in management decision-making, with a particular focus on the Technology-Organization-Environment (TOE) framework. The TOE model [5] provides a comprehensive framework for understanding the factors influencing the adoption and implementation of new technologies in organizations.

3.1 Technology-Organization-Environment (TOE) Framework

The TOE framework is a widely accepted model for analyzing the adoption of new technologies in organizations. It categorizes the factors influencing technology adoption into three dimensions: technological, organizational, and environmental. Tornatzky and Fleischer originally developed this framework to study the diffusion of innovations, and it has since been applied extensively in various contexts, including the adoption of AI in management decision-making.

Technological Factors. Technological factors refer to the characteristics of technology itself. Key attributes include relative advantages, compatibility, complexity, trialability, and observability [6]. Relative advantage, the degree to which a new technology is perceived as better than the existing one, is a significant driver of adoption. Compatibility, the extent to which technology fits with the organization's existing processes and culture, also plays a crucial role. Complexity, the difficulty associated with understanding and using technology, can be a barrier if perceived as too high. Trialability and observability, the ability to test technology and observe its results, respectively, can facilitate adoption by reducing uncertainty.

Organizational Factors. Organizational factors encompass the internal characteristics of the organization that influence technology adoption. These include organizational size, structure, culture, and resources. Larger organizations with more resources are often better positioned to adopt and implement new technologies [7]. Organizational culture, particularly one that is innovation-friendly, can also facilitate the adoption process. Additionally, the organization's readiness for change, including the availability of skilled personnel and the presence of a supportive management team, is critical for successful implementation.

Environmental Factors. Environmental factors refer to external pressures and influences that affect technology adoption. These include competitive pressure, regulatory requirements, and technological trends. External pressure from competitors can drive organizations to adopt new technologies to maintain a competitive edge [8]. Government policies and regulations can also play a significant role in encouraging or mandating the adoption of certain technologies. Technological trends and advancements in the broader environment can create opportunities or necessitate changes in organizational practices.

3.2 AI in Management Decision-Making

AI in management decision-making has drawn much attention. Technologies like machine learning and predictive analytics boost efficiency and accuracy by processing data, spotting patterns, and generating insights. These technologies can process vast amounts of data, identify patterns, and generate insights that might be missed by human decision-makers [9]. AI-driven DSS handle unstructured data, offering real-time analytics and scenario simulations. This enables more dynamic and adaptive decision-making [10]. Big data analytics with AI aids strategic planning and CRM. This capability is particularly valuable in dynamic environments where decisions need to be made quickly and accurately [11]. AI also enhances predictive analytics for demand forecasting and risk management. Predictive analytics is particularly useful in areas such as demand forecasting, risk management, and resource allocation [12].

3.3 TOE Model and AI Adoption in Management Decision-Making

The TOE framework aids understanding of AI adoption in management decision-making. AI's ability to improve decision accuracy and speed is often cited as a key benefit [13]. However, complexity can hinder adoption. The complexity of AI technologies can be a barrier, particularly for organizations lacking technical expertise [14].

4 Model and Hypothesis

4.1 Theoretical Framework

This study examines AI adoption in Shudao Group's management decision-making using the TOE framework, which categorizes factors into technological, organizational, and environmental dimensions. Compatibility, security, and portability are also key. Organizationally, management support, resource readiness, an innovation-friendly culture, and robust IT infrastructure facilitate adoption. Environmentally, government policies, competitive pressures, and industry standards shape the landscape, incentivizing or necessitating AI adoption for innovation and competitiveness.

4.2 Research Model

Based on the TOE framework, a research model is developed to explore the relationships between technological, organizational, and environmental factors and the adoption of AI in management decision-making at Shudao Group. The model is illustrated in Figure 1.

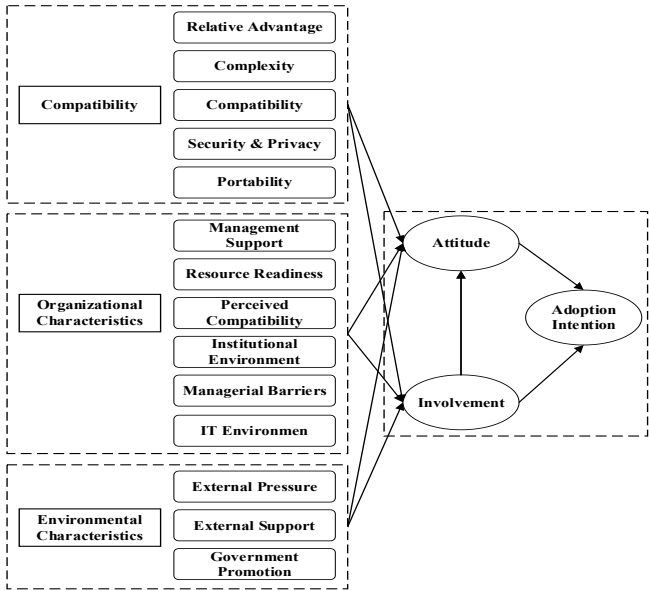


Fig. 1. relationships between technological, organizational, and environmental factors and the adoption of AI in management decision-making

4.3 Hypotheses Development

Technological Factors and AI Adoption. The relative advantage of AI is expected to positively influence Shudao Group's attitude and involvement in AI adoption, as it directly impacts decision-making efficiency and accuracy. Thus, we hypothesize:

H1a: The relative advantage of AI positively affects Shudao Group's attitude toward AI adoption. H1b: The relative advantage of AI enhances Shudao Group's involvement in AI adoption. However, the complexity of AI may pose challenges, potentially reducing the organization's attitude and involvement. Hence: H2a: The complexity of AI negatively affects Shudao Group's attitude toward AI adoption. H2b: The complexity of AI reduces Shudao Group's involvement in AI adoption. Compatibility is crucial for seamless integration. We expect: H3a: The compatibility of AI with existing systems positively affects Shudao Group's attitude toward AI adoption. H3b: The compatibility of AI with existing systems enhances Shudao Group's involvement in AI adoption. Security and privacy concerns may deter adoption, leading to: H4a: Security and privacy concerns negatively affect Shudao Group's attitude toward AI adoption. H4b: Security and privacy concerns reduce Shudao Group's involvement in AI adoption. Portability, or the adaptability of AI systems, is anticipated to encourage a positive attitude and higher involvement: H5a: The portability of AI systems positively affects Shudao Group's attitude toward AI adoption. H5b: The portability of AI systems enhances Shudao Group's involvement in AI adoption.

Organizational Factors and AI Adoption. Management support is foundational for AI adoption. We hypothesize:

H6a: Management support positively affects Shudao Group's attitude toward AI adoption. H6b: Management support enhances Shudao Group's involvement in AI adoption. Resource readiness ensures the necessary backing for AI initiatives: H7a: Resource readiness positively affects Shudao Group's attitude toward AI adoption. H7b: Resource readiness enhances Shudao Group's involvement in AI adoption. An innovation-friendly culture is expected to facilitate AI adoption: H8a: Perceived compatibility with organizational culture positively affects Shudao Group's attitude toward AI adoption. H8b: Perceived compatibility with organizational culture enhances Shudao Group's involvement in AI adoption. A favorable institutional environment can encourage AI adoption: H9a: A favorable institutional environment positively affects Shudao Group's attitude toward AI adoption. H9b: A favorable institutional environment enhances Shudao Group's involvement in AI adoption. Conversely, management barriers may hinder adoption: H10a: Management barriers negatively affect Shudao Group's attitude toward AI adoption. H10b: Management barriers reduce Shudao Group's involvement in AI adoption. Robust IT infrastructure is anticipated to support AI adoption: H11a: IT infrastructure positively affects Shudao Group's attitude toward AI adoption. H11b: IT infrastructure enhances Shudao Group's involvement in AI adoption.

Environmental Factors and AI Adoption. Government policy support is expected to foster a positive attitude and higher involvement:

H12a: Government policy support positively affects Shudao Group's attitude toward AI adoption. H12b: Government policy support enhances Shudao Group's involvement

in AI adoption. External market pressure may drive AI adoption to maintain competitiveness:H13a: External market pressure positively affects Shudao Group's attitude toward AI adoption.H13b: External market pressure enhances Shudao Group's involvement in AI adoption. External support, such as partnerships, is anticipated to encourage AI adoption:H14a: External support positively affects Shudao Group's attitude toward AI adoption.H14b: External support enhances Shudao Group's involvement in AI adoption.

Mediating Roles of Involvement and Attitude. Involvement in AI adoption is expected to mediate the relationship between technological factors and adoption intention:

H15: Higher involvement in AI adoption leads to a more positive attitude toward AI in management decision-making at Shudao Group.H16: Higher involvement in AI adoption strengthens Shudao Group's intention to adopt AI in management decision-making. Attitude is also anticipated to mediate the relationship between organizational and environmental factors and adoption intention:H17: A more positive attitude toward AI adoption enhances Shudao Group's intention to adopt AI in management decision-making.

5 Methodology

The study employs a mixed-methods approach, combining quantitative and qualitative data to provide a comprehensive understanding of the factors influencing AI adoption. The methodology is structured around the Technology-Organization-Environment (TOE) framework, which serves as the theoretical foundation for this research.

5.1 Research Design

The research uses a survey methodology targeting Shudao Group's senior managers. A questionnaire based on the TOE framework was developed, with a pre-test refining it for clarity and validity using a 7-point Likert scale.

5.2 Sampling and Data Collection

The study targets Shudao Group's senior managers across departments. 205 valid responses from 215 questionnaires (95.35% rate) ensure representative findings. Respondents, mostly in senior roles like GM, offer strategic insights.

5.3 Data Analysis

Table 1. Descriptive statistical analysis

Variable	Category	Frequency	Percentage	Valid percentage	Cumulative Percentage
Position	General Manager	59	28.8	28.8	28.8
	Deputy General Manager	26	12.7	12.7	41.5

Director	25	12.2	12.2	53.7
Department Manager	26	12.7	12.7	66.3
Supervisor	45	22	22	88.3
Middle Management	24	11.7	11.7	100

Table 1 shows respondent position characteristics and AI software budget distribution. Over half are senior managers, reflecting executives' views. High-budget samples (50.7%) dominate, indicating enterprises' high AI investment expectations. This ensures representative, scientific research results for subsequent analysis.

Table 2. Reliability coefficients of each variable

Variable	Cronbach's α coefficient	Guttman split half reliability
Technical characteristics	0.95	0.9
Organizational characteristics	0.973	0.947
Environmental characteristics	0.969	0.923
Involvement	0.922	0.794
Attitude	0.954	0.912
Adoption intention	0.946	0.948

As Table 2 shows, reliability analysis used Cronbach's α and Guttman's split-half coefficients. Technical (0.950/0.900), organizational (0.973/0.947), and environmental (0.969/0.923) features questionnaires were highly reliable. Involvement (0.922/0.794), attitude (0.954/0.912), and adoption willingness (0.946/0.948) questionnaires also showed good reliability.

Table 3. Validity tests of each variable

Variable category	Number of entries	Scope of commonality	Factor load range	Validity evaluation
technical feature	17	0.422-0.707	0.650-0.841	Good
characteristics	22	0.488-0.746	0.698-0.864	Good
environmental characteristics	17	0.466-0.798	0.682-0.893	Good
Involvement degree	3	0.832-0.903	0.912-0.950	Good
Attitude	5	0.805-0.887	0.897-0.942	Good
Willingness to adopt	4	0.790-0.909	0.889-0.954	Good

To test questionnaire validity (Table 3), exploratory factor analysis via principal component analysis was used. Technical (17 items), organizational (22 items), and environmental (17 items) features all met validity criteria. Involvement (3 items), attitude (5 items), and adoption willingness (4 items) also showed good validity with relevant metrics meeting standards.

Table 4. Correlation analysis results among variables

	1	2	3	4	5	6
1. Technical features	1					
2.Organizational characteristics	0.797*	1				
3.Environmental characteristics	0.713*	0.87*	1			

4. Involvement degree	0.702*	0.727*	0.769*	1		
5. Attitude	0.729*	0.74*	0.789*	0.871*	1	
6. Willingness to adopt	0.620*	0.759*	0.816*	0.758*	0.804*	1

Note: * represents $p < 0.05$, represents $p < 0.01$, * represents $p < 0.001$.

Table 4 reveals significant positive correlations between technical, organizational, and environmental characteristics and outcome variables in CT company. Correlations among factors and outcomes are high, with involvement-attitude-adoption intention showing a strong escalating chain. SEM tested hypotheses and model fit using indices like χ^2/df , GFI, RMSEA, verifying variable logic and laying a foundation for further analysis, with no severe multicollinearity.

5.4 Research Model and Hypotheses Testing

The effect of technical characteristics on adoption intention. In the first model of this study (Model 1), we construct a structural equation model in which various aspects of technical features such as comparative advantage, complexity, compatibility, security and privacy, and portability are incorporated as independent variables. At the same time, involvement and attitude were set as mediating variables, and final adoption willingness as dependent variables. The fit index of model 1 showed good model fit, namely χ^2/df was 0.456, GFI was 0.997, AGFI was 0.980, NFI was 0.998, RFI was 0.990, and RMSEA was 0.01. The results of this model are detailed in Table 5 and Fig. 2.

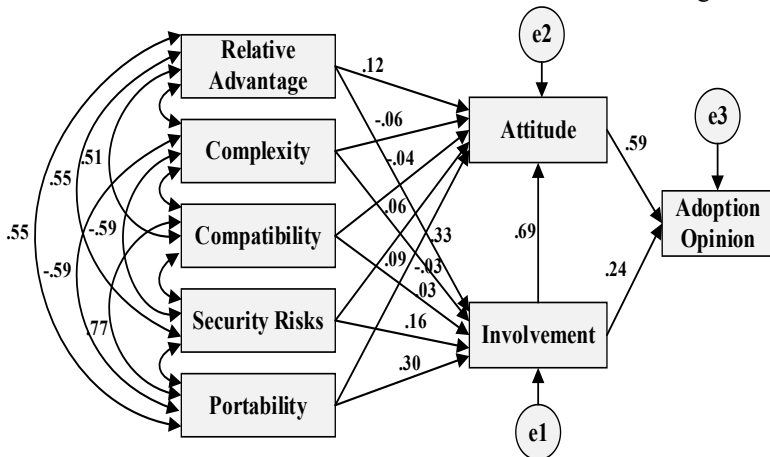


Fig. 2. Model 1

AI's relative advantage positively impacted CT's attitude ($\beta=0.124$, $p < 0.01$) and involvement ($\beta=0.335$, $p < 0.001$), supporting H1a & H1b. Complexity, compatibility, and security/privacy had no significant negative/positive effects, refuting H2a-H4b. Portability didn't affect attitude ($\beta=0.094$, $p > 0.05$) but boosted involvement ($\beta=0.300$, $p < 0.001$), backing H5b. CT's involvement strongly correlated with attitude ($\beta=0.692$, $p < 0.001$) and adoption willingness ($\beta=0.241$, $p < 0.01$), validating H15 & H16. A strong positive attitude-intention link ($\beta=0.593$, $p < 0.001$) also confirmed H17.

Table 5. Path coefficients of Model 1

Path direction	Estimate	S.E.	C.R.	P	Standardized path coefficient
Involvement < -- Relative advantage	0.373	0.071	5.259	*	0.335
Involvement < -- compatibility	0.032	0.101	0.314	0.754	0.030
Involvement < -- Security and privacy	0.174	0.087	2.008	0.045	0.157
Involvement < -- portability	0.321	0.085	3.757	*	0.300
Involvement < -- Complexity	-0.030	0.082	-0.361	0.718	-0.028
Attitude < -- Involvement	0.704	0.047	14.885	*	0.692
Attitude < -- Comparative advantage	0.140	0.051	2.746	0.006	0.124
Attitude < -- Complexity	-0.063	0.056	-1.136	0.256	-0.058
Attitude < -- Compatibility	-0.043	0.069	-0.627	0.531	-0.040
Attitude < -- Security and privacy	0.069	0.059	1.164	0.244	0.061
Attitude < -- Portability	0.102	0.060	1.709	0.087	0.094
Willingness to adopt < -- Involvement	0.258	0.089	2.905	0.004	0.241
Adoption willingness < -- attitude	0.625	0.087	7.144	*	0.593

Note: * means $p < 0.05$, $p < 0.01$, * means $p < 0.001$.

In mediation tests, comparative advantage, security/privacy, and portability indirectly influence adoption intention via involvement, with significant effects. Attitude also mediates this link. Chain mediation for all factors is notable. Model 2, adding organizational traits like IT environment, fits well post IT-path inclusion (details in Fig. 3, Table 6).

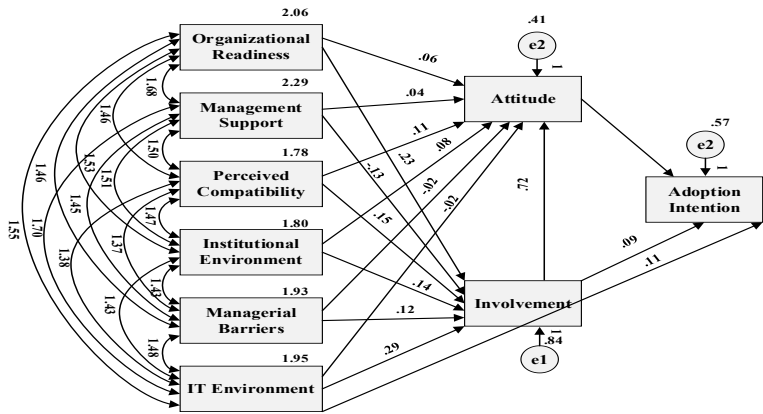


Fig. 3. Model 2

Analyzing AI factors' impact on firm attitude and involvement: Manager support has no significant effect on either (H6a, H6b invalid). Organizational resource accuracy boosts involvement ($\beta=0.245$, $p < 0.001$, H7b valid) but not attitude. Perceived compatibility, institutional environment, and management barriers lack significant effects (H8a-H10b invalid). IT environment enhances involvement significantly ($\beta=0.295$, $p < 0.001$, H11b valid) but not attitude.

Table 6. Path coefficients of Model 2

1. Path direction	Estimate	S.E.	C.R.	P	Standardized path coefficient
2. Involvement < -- Organizational readiness	0.234	0.087	2.696	0.007	0.245
3. Involvement < -- Manager support	-0.128	0.081	-1.587	0.113	-0.141
4. Involvement < -- Perceived compatibility	0.151	0.094	1.605	0.108	0.146
5. Involvement < -- institutional environment	0.142	0.100	1.419	0.156	0.139
6. Involvement < -- Management barriers	0.124	0.082	1.515	0.130	0.125
7. Involvement < --IT environment	0.290	0.092	3.153	0.002	0.295
8. Attitude < -- Organizational readiness	0.065	0.062	1.043	0.297	0.066
9. Attitude < -- manager support	0.039	0.057	0.689	0.491	0.042
10. Attitude < -- Perceived compatibility	0.112	0.066	1.693	0.090	0.107
11. Attitude < -- Institutional environment	0.083	0.071	1.173	0.241	0.080
12. Attitude < -- Management barriers	-0.023	0.058	-0.399	0.690	-0.023
13. Attitude < --IT environment	-0.017	0.066	-0.261	0.794	-0.017
14. Attitude < -- Involvement	0.716	0.049	14.579	*	0.704
15. Adopt willingness < attitude	0.494	0.079	6.259	*	0.469
16. Willingness to adopt < -- Involvement	0.092	0.081	1.138	0.255	0.086
17. Willingness to adopt < --IT environment	0.407	0.053	7.694	*	0.387

Note: * means $p < 0.05$, $p < 0.01$, * means $p < 0.001$.

Mediation analyses show organizational readiness and IT environment boost involvement, with minor indirect effects on adoption intention. Both also influence intention via attitude. Model 3 adds environmental factors, fits well post-adjustment (details in Fig. 4, Table 7).

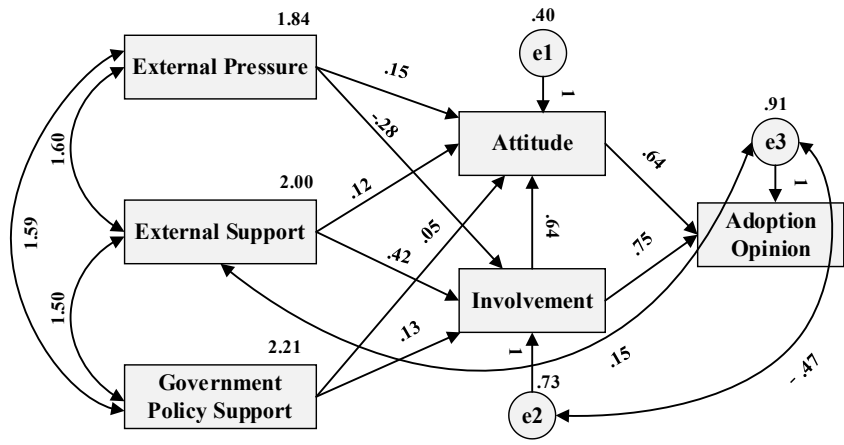


Fig. 4. Model 3

Assessing AI-related external factors' impact on corporate attitudes and involvement:

- 1. Gov't policy support: Positively affects involvement significantly ($\beta=0.139, p<0.05$, H12b valid), but not attitude ($\beta=0.058, p>0.05$, H12a invalid).
- 2. External pressure: Boosts both ($\beta=0.148/0.278, p<0.05/<0.001$, H13a/b valid).
- 3. External support: Marginally positive on attitude ($\beta=0.118, p=0.05$, H14a valid), significantly on involvement ($\beta=0.421, p<0.001$, H14b valid).

Table 7. Path coefficients of Model 3

18. Path direction	19. Estimate	20. S.E.	21. C.R.	22. P	23. Standardized path coefficient
24. Involvement < -- external pressure	25. 0.282	26. 0.085	27. 3.312	28. *	29. 0.278
30. Involvement < -- External support	31. 0.409	32. 0.078	33. 5.261	34. *	35. 0.421
36. Involvement < -- Government policy support	37. 0.128	38. 0.055	39. 2.333	40. 0.020	41. 0.139
42. Attitude < -- external pressure	43. 0.153	44. 0.070	45. 2.168	46. 0.030	47. 0.148
48. Attitude < -- External support	49. 0.116	50. 0.062	51. 1.890	52. 0.059	53. 0.118
54. Attitude < -- Government policy support	55. 0.054	56. 0.050	57. 1.089	58. 0.276	59. 0.058
60. Attitude < -- Involvement	61. 0.644	62. 0.052	63. 12.379	64. *	65. 0.634
66. Adopt willingness < attitude	67. 0.391	68. 0.083	69. 4.681	70. *	71. 0.371
72. Willingness to adopt < - Involvement	73. 0.746	74. 0.109	75. 6.865	76. *	77. 0.697

Note: * means $p < 0.05$, $p < 0.01$, * means $p < 0.001$.

Using model fitting and Bootstrap, mediating effects were analyzed. External pressure/support significantly impacted involvement & indirectly influenced adoption. Policy support marginally affected it. In attitude-mediated paths, no significant indirect effects were found. Chain mediation effects were significant.

6 Results and Discussion

6.1 Variable Effect Differences

The study found significant differences in factors affecting Shudao Group's AI-driven management decision-making transformation. AI's relative advantage was a key driver, influencing adoption and attitudes. Security concerns impacted attitudes, while resource readiness was critical. External pressures and supportive policies also played pivotal roles in driving the transformation.

6.2 Structural Model Findings

Structural model analysis shows technological factors (e.g., relative advantage, portability) impact decision-making transformation directly and indirectly via engagement. Security concerns have indirect effects. External pressures (competition) and supports (policies) boost AI engagement, shaping attitudes and driving transformation. Technological superiority directly raises AI awareness, while other factors mainly operate indirectly.

6.3 Hypotheses Validation

Hypotheses on AI's relative advantage and portability are confirmed, validating their positive impact on adoption. Complexity and compatibility hypotheses are unsupported, suggesting current AI platforms have overcome these barriers. Organizational resource readiness hypotheses are validated, while management support and cultural compatibility hypotheses are insignificant. External pressures and supports hypotheses are largely confirmed, with government policies indirectly fostering innovation.

7 Conclusion and Implication

7.1 Main Research Findings

This study analyzes AI adoption in Shudao Group's management decision-making using the TOE framework. It reveals issues like long decision cycles and over-reliance on subjective experience. AI's advantage in accuracy and speed, along with support and resources, drives adoption. Technological, organizational, and environmental factors jointly influence AI integration.

7.2 Theoretical Contributions

This study enriches management decision-making research. It extends TOE framework to AI adoption, highlights key factors, and bridges theory gaps, enhancing decision efficacy.

7.3 Management Implications

Findings guide Shudao Group and others in AI-driven decision-making. Prioritize intelligent systems using AI/big data. Ensure resource readiness, management support, and a culture of innovation. Engage external stakeholders to leverage support and mitigate risks.

7.4 Future Research Directions

Future research should expand samples, include more variables, and use longitudinal studies. This study highlights AI's role in decision-making, aiding strategic integration for competitive edge.

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