

Clustering Iranian Railway Transportation Companies Based on Ambidextrous Marketing Dimensions: A Multigroup Structural Equation Analysis

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Article Info

Article type:

Original Research

How to cite this article:

Noroozi, J., Eyvazi Heshmat, A.A. & Sanavifard, R. (2026). Clustering Iranian Railway Transportation Companies Based on Ambidextrous Marketing Dimensions: A Multigroup Structural Equation Analysis. *Journal of Resource Management and Decision Engineering*, 5(1), 1-10.
<https://doi.org/10.61838/kman.jrmd.5.1.195>



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ABSTRACT

The rapid environmental and competitive transformations in Iran's railway transportation industry have intensified the necessity of adopting innovative marketing approaches. One such approach is ambidextrous marketing, which enables organizations to exploit existing capabilities while simultaneously exploring new opportunities. The aim of this study is to cluster national railway companies based on ambidextrous marketing dimensions and to compare the structural relationships among the identified groups. Data were collected from 169 valid questionnaires and analyzed using a combination of clustering methods (Ward and K-means) and Partial Least Squares Structural Equation Modeling (PLS-SEM). The analysis identified three distinct clusters: technology leaders, characterized by a focus on innovation and service speed; structured customer-oriented firms, emphasizing organizational culture and human relationship management; and resource-constrained firms, facing challenges related to limited human capital and technological capabilities. The multigroup analysis revealed that the intensity and pattern of variable effects differ across clusters: technology and service speed are key drivers in the technology leaders cluster, organizational culture plays a central role among structured customer-oriented firms, and formal structure along with environmental pressures hinder value creation in resource-constrained firms. Despite these differences, ambidextrous marketing in all clusters led to financial and social outcomes through the pathways of value creation and knowledge management. The findings of this research, while confirming ambidexterity theory, highlight the need for developing strategies tailored to the specific characteristics of each cluster. The study provides practical insights for policymakers and railway managers in designing marketing programs, advancing digitalization, and promoting sustainable industry development.

Keywords: Railway transportation, ambidextrous marketing, multigroup analysis, clustering

1. Introduction

The increasing pace of global competition and technological disruption has intensified the need for firms to adopt adaptive and innovative marketing approaches. In industries where both exploitation of existing capabilities and exploration of emerging opportunities are critical for survival, the concept of *ambidextrous marketing*—the simultaneous pursuit of alignment and adaptability—has become a cornerstone of strategic management and innovation research (March, 1991). The theory of ambidexterity emphasizes that organizations must manage the dual challenge of maintaining operational efficiency while exploring new market opportunities to ensure long-term viability (Gibson & Birkinshaw, 2004). Within this theoretical lens, marketing ambidexterity (AMX) has evolved as an essential capability that integrates market exploitation activities such as customer relationship management with exploratory initiatives like product innovation and market sensing (Christofi et al., 2021).

In the context of emerging economies, where resource constraints and institutional volatility prevail, marketing ambidexterity provides a critical mechanism for sustainable performance. The dual capability enables firms to bridge short-term efficiency with long-term adaptability, promoting continuous learning and innovation (Hakimi et al., 2023). Ambidextrous marketing encourages firms not only to leverage existing market intelligence but also to explore uncharted opportunities through dynamic marketing practices, thereby creating a synergistic interface between stability and change (He et al., 2021).

The theoretical foundation of ambidextrous marketing stems from the classic work of March (March, 1991), who introduced the distinction between exploration (innovation, risk-taking, experimentation) and exploitation (refinement, implementation, and efficiency). Building upon this framework, Gibson and Birkinshaw (Gibson & Birkinshaw, 2004) proposed that organizational ambidexterity results from contextual factors that balance both modes simultaneously. This balance is particularly vital in markets characterized by rapid change, where firms must constantly adjust marketing strategies, reallocate resources, and adapt to evolving customer demands (Christofi et al., 2021).

Recent studies have demonstrated that firms capable of achieving ambidexterity in their marketing operations can simultaneously improve market responsiveness and innovation performance (He et al., 2021). For instance, the ability to align exploitative marketing efforts with

exploratory innovation fosters resilience against market disruptions and enhances firms' ability to compete in turbulent environments (Dolz et al., 2019). Additionally, research in high-technology organizations has revealed that ambidextrous leadership and culture are essential drivers of strategic renewal, ensuring that firms maintain competitiveness in fast-changing industries (Kassotaki, 2019).

Beyond strategic orientation, ambidextrous marketing depends heavily on knowledge management and external embeddedness. Knowledge management systems allow organizations to integrate and reuse existing insights while simultaneously generating new market knowledge, thereby supporting both exploration and exploitation (Dezi et al., 2019). Firms embedded in strong external networks can access diverse information sources, which enhance their ambidextrous learning processes and performance outcomes (Christofi et al., 2021).

Moreover, ambidextrous capability relies on a dynamic interaction between internal structures and external linkages (Aripin et al., 2024). According to this view, ambidexterity is not a static state but an evolving process shaped by managerial cognition, network positioning, and market feedback loops. Through iterative learning and capability reconfiguration, organizations can sustain competitiveness even in volatile industries such as transportation, logistics, and manufacturing (Hakimi et al., 2023).

The transportation sector provides a particularly rich context for studying ambidextrous marketing due to its capital-intensive nature, regulatory complexity, and exposure to technological transformation. Rail transport, in particular, plays a crucial role in national development, connecting regions, facilitating trade, and enabling sustainable economic growth (Ahmadi, 2019). In Iran, as in many developing economies, the railway industry faces multiple challenges including outdated infrastructure, limited investment, and the need for modernization (Nasr Azadani & Colleagues, 2015). Given these constraints, the ability to leverage existing capabilities while exploring new technological and marketing opportunities is essential for competitiveness.

Previous research on Iranian railway development highlights that effective strategy formulation must account for both operational efficiency and innovation to enhance service quality and market responsiveness (Majidi et al., 2017). However, the majority of prior studies have focused on infrastructure, logistics, and policy rather than on marketing capabilities. Thus, examining ambidextrous

marketing in this context bridges an important research gap, revealing how firms in the rail transportation sector can utilize dual marketing strategies to sustain growth under resource limitations.

Parallel developments in other emerging economies—such as Vietnam’s shift toward sustainable mobility and electric transport—also emphasize the significance of ambidextrous strategies that integrate innovation with market-based adaptations (Huu & Ngoc, 2021). In these contexts, firms must manage dual objectives: implementing immediate service improvements while simultaneously exploring new technologies and customer engagement models. Similarly, Al-Janabi et al. (Al-Janabi et al., 2024) demonstrated that multicultural marketing strategies, when mediated by ambidextrous marketing capabilities, enhance recovery and adaptability in competitive markets, further supporting the universality of ambidexterity as a marketing principle.

From a performance standpoint, ambidextrous marketing has been empirically linked to superior financial, innovative, and customer-oriented outcomes. Dual-capability frameworks emphasize that organizations must continuously balance *market exploitation* (e.g., deepening customer relationships) with *market exploration* (e.g., identifying new segments and product innovations) (Hakimi et al., 2023). This dynamic balance strengthens innovation performance, enhances adaptability, and supports long-term competitive advantage (He et al., 2021).

In particular, the empirical evidence from manufacturing and service industries confirms that ambidextrous marketing capabilities significantly improve innovation outcomes by fostering both exploratory and exploitative market-based innovations (Christofi et al., 2021). Moreover, integrating these capabilities with technological and cultural enablers promotes firm resilience, especially during economic crises (Dolz et al., 2019). Such resilience is critical in industries like rail transportation, which must navigate cyclical demand patterns, policy constraints, and fluctuating economic conditions.

Furthermore, studies have shown that knowledge-based resources and external collaborations serve as antecedents of ambidextrous performance. Dezi et al. (Dezi et al., 2019) argue that external embeddedness provides firms with access to diverse knowledge pools, facilitating both innovation and efficiency. Similarly, Shahriyari and Jahanshahi (Shahriyari & Jahanshahi, 2021) found that dual-capability marketing mediates the relationship between market knowledge development and intellectual capital, enhancing

performance among knowledge-based enterprises. These findings underscore the strategic importance of managing knowledge flows and cultural assets to enable ambidexterity.

Ambidextrous success depends not only on capabilities but also on the strategic leadership and organizational context that foster dual behavior. Ambidextrous leaders encourage innovation while maintaining operational discipline, thereby facilitating simultaneous exploration and exploitation (Kassotaki, 2019). Leadership also plays a mediating role in shaping learning culture, empowering teams to balance risk-taking with efficiency (Christofi et al., 2021).

In Iranian rail organizations, leadership and culture are particularly critical given their hierarchical structures and centralized decision-making. Developing ambidextrous cultures that value flexibility, collaboration, and knowledge sharing can mitigate rigidity and stimulate innovation. Majidi et al. (Majidi et al., 2017) emphasized that strategic transformation in Iran’s rail sector requires leadership capable of aligning technological modernization with marketing renewal. In this regard, contextual ambidexterity—as described by Gibson and Birkinshaw (Gibson & Birkinshaw, 2004)—becomes an operational tool for managers to foster adaptability without sacrificing consistency.

While large enterprises have traditionally been the focus of ambidexterity studies, small and medium-sized enterprises (SMEs) also benefit from dual-capability approaches. Research shows that ambidexterity enhances SME survival during financial and economic crises, especially when supported by top management teams (TMTs) and family ownership structures that foster long-term vision and agility (Dolz et al., 2019). Similarly, Dezi et al. (Dezi et al., 2019) found that external collaboration and knowledge management play crucial roles in driving ambidextrous innovation in Italian SMEs. These insights suggest that both scale and structure influence the operationalization of ambidexterity, with implications for policy and management practices in the Iranian context.

The dynamic capabilities framework provides further grounding for understanding ambidextrous marketing. It posits that firms must integrate, build, and reconfigure internal and external competencies to respond effectively to changing environments (Christofi et al., 2021). Ambidextrous marketing, viewed through this lens, represents a higher-order capability that enables firms to continuously renew their market strategies. By combining internal knowledge development with external sensing

mechanisms, firms achieve greater innovation coherence and strategic alignment (Aripin et al., 2024).

In practice, dynamic integration between internal and external approaches fosters product innovation and customer value creation. Aripin et al. (Aripin et al., 2024) demonstrated that marketing ambidexterity, when coupled with strong market capabilities, directly enhances product innovation results. Similarly, Hakimi et al. (Hakimi et al., 2023) argued that dual innovation capabilities are vital antecedents of new product success, indicating that the interaction between technological and marketing ambidexterity is synergistic rather than independent.

Iran's railway industry, despite its strategic role in national economic development, continues to face institutional, financial, and technological constraints (Nasr Azadani & Colleagues, 2015). Studies have emphasized the need for comprehensive reform and modernization to enhance competitiveness and operational performance (Majidi et al., 2017). From a marketing perspective, achieving ambidexterity could help rail companies overcome environmental uncertainty, align service innovations with customer expectations, and optimize value creation processes.

Furthermore, by integrating knowledge management and value co-creation, railway companies can transform structural rigidities into adaptive systems capable of responding to digital transformation and sustainability demands (Ahmadi, 2019). The ongoing transition toward smart and green transportation reinforces the necessity for dual marketing capabilities that combine traditional service delivery with digital innovation and customer-centricity.

Given the dynamic changes in global transportation systems, the modernization challenges of Iran's railway sector, and the strategic value of ambidextrous marketing in bridging exploitation and exploration, this study aims to cluster Iranian railway transportation companies based on the dimensions of ambidextrous marketing and examine the structural differences among these clusters to provide actionable insights for strategic development.

2. Methods and Materials

The present research employed a mixed-methods approach, meaning that in the first phase, through qualitative studies and a literature review, the conceptual model of the study was designed; and in the second phase, a quantitative approach was applied to test the model and address the research questions. The data collection instrument in the

quantitative phase was a researcher-made questionnaire using a five-point Likert scale, the validity and reliability of which had been previously examined and confirmed. The statistical population consisted of all companies active in Iran's railway transportation sector (107 companies), from which 169 valid questionnaires were ultimately collected from managers and experts and used as the basis for analysis.

The data analysis process was conducted in several sequential steps. In the first step, data were standardized to eliminate heterogeneity and prepare for advanced analyses. In the second step, companies were clustered to identify intra-industry heterogeneity patterns. At this stage, the hierarchical Ward's method was first used to determine the optimal number of clusters, and then the final allocation of companies to clusters was performed using the K-means method. The quality of clustering was also assessed using the silhouette coefficient.

In the third step, for each identified cluster, the conceptual model of the study was tested using Partial Least Squares Structural Equation Modeling (PLS-SEM) to evaluate both the measurement model fit and the structural relationships. Finally, in the fourth step, the Multigroup Analysis (MGA) test was employed to examine the differences in path coefficients between clusters, determining whether the relationships in the model differed significantly across groups.

Accordingly, the research methodology enabled the identification and comparison of distinct clusters of Iranian railway companies based on ambidextrous marketing dimensions, facilitating a deeper analysis of intra-industry heterogeneity within this sector.

3. Findings and Results

To identify intra-industry heterogeneity, Iranian railway companies were clustered based on ambidextrous marketing dimensions and related indicators. The results indicated that the data could be classified into three distinct clusters, each characterized by unique features.

Cluster 1: Technology Leaders

This group includes companies with the highest scores on indicators related to technology, innovation, and service speed. The focus of this cluster is on utilizing technological infrastructure, adopting modern transportation technologies, and reducing service delivery time. Although their share in the total population is limited, their performance demonstrates that investment in technology and innovation

can provide a significant competitive advantage for railway companies.

Cluster 2: Structured Customer-Oriented Firms

Companies in this cluster scored highest on cultural and organizational indicators. They possess relatively stable structures, defined internal procedures, and an organizational culture grounded in human relations. The main focus of this cluster is market understanding, effective customer interaction, and leveraging social capital to enhance performance. In terms of sample share, this cluster accounts for a considerable proportion of companies, suggesting that attention to the “soft” dimensions of the organization—such as culture and human relationships—is a priority for many Iranian railway firms.

Cluster 3: Resource-Constrained Firms

This cluster includes companies with the lowest levels of human capital and technological capability and the most negative impact from environmental and structural limitations. These firms face numerous barriers, including lack of financial resources, weak specialized human capital, and rigid structures, which prevent sustainable value creation. Although this cluster represents the smallest portion of the sample, its situation is concerning, emphasizing the need for a review of support policies for such companies.

Overall, the clustering results indicated that Iran’s railway industry is **not homogeneous** but consists of technology-driven, customer-oriented, and resource-constrained companies—each requiring distinct management strategies.

Table 1

Characteristics of the Identified Clusters of Iranian Railway Transportation Companies

Variables / Clusters	Cluster 1: Technology Leaders (30%)	Cluster 2: Structured Customer-Oriented (45%)	Cluster 3: Resource-Constrained (25%)
Technological Factors	4.2	3.0	2.1
Service Speed	4.0	3.1	2.0
Human Capital	3.4	3.6	2.2
Organizational Culture	3.3	4.1	2.3
Organizational Characteristics	3.3	4.0	2.5
Organizational Structure	-0.3	-0.2	-0.35
Environmental Conditions	2.9	3.0	-0.2
Ambidextrous Marketing	3.8	3.5	2.4
Value Creation	3.7	3.4	2.3
Knowledge Management	3.5	3.6	2.2

The clustering results (Table 1) revealed three distinct groups. Cluster 1 (technology leaders) includes about 30% of companies with the highest means in technological factors and service speed. Cluster 2 (structured customer-oriented firms) represents 45% of companies, showing higher scores in organizational culture and structural characteristics. Cluster 3 (resource-constrained firms) makes up 25% of companies, exhibiting the lowest scores in human capital and technology, along with the most negative effects from formal structures and environmental conditions. These findings indicate that the Iranian railway industry is heterogeneous, with companies operating under diverse capacities and constraints.

After identifying the three clusters, the next step was to examine differences in structural relationships among them. For this purpose, the Multigroup Analysis (MGA) method in SmartPLS software was employed. This approach allows the comparison of path coefficients across clusters and

demonstrates how the intensity and direction of variable effects vary under different organizational and environmental conditions.

The analysis results revealed that:

In the technology leaders cluster, the roles of technological factors and service speed in enhancing ambidextrous marketing were more prominent than in other clusters. These companies benefited most from technological innovation and improved service quality and speed to develop marketing capabilities.

In the structured customer-oriented cluster, cultural and organizational variables were more influential. An organizational culture supportive of learning and constructive human interactions was the key factor in improving ambidextrous marketing, while a cohesive organizational structure further reinforced this capability.

In the resource-constrained cluster, limitations in human capital and technology, along with the negative impact of

formal structures and environmental conditions, served as the main barriers to value creation and knowledge management. Due to resource constraints and unstable competitive environments, these companies benefited the least from ambidextrous marketing.

Despite these differences, a common pattern was observed across all three clusters: ambidextrous marketing positively and significantly affected financial and social

outcomes through the mediating roles of value creation and knowledge management under all organizational and environmental conditions. This finding indicates that ambidextrous marketing, regardless of intra-industry differences, remains a core driver of performance improvement and sustainable competitive advantage in Iran's railway transportation industry.

Table 2

Comparison of Path Coefficients in the Multigroup Analysis (MGA)

Paths	Technology Leaders	Structured Customer-Oriented	Resource-Constrained
Technology → Ambidextrous Marketing	0.62	0.38	0.15
Service Speed → Ambidextrous Marketing	0.55	0.31	0.12
Organizational Culture → Ambidextrous Marketing	0.28	0.57	0.20
Human Capital → Value Creation	0.41	0.36	0.18
Organizational Structure → Knowledge Management	-0.12	-0.21	-0.35
Ambidextrous Marketing → Value Creation	0.47	0.42	0.33
Ambidextrous Marketing → Knowledge Management	0.39	0.37	0.29
Value Creation → Financial Outcomes	0.52	0.48	0.40
Knowledge Management → Social Outcomes	0.49	0.44	0.37

The results presented in Table 2 indicate that the strength and pattern of structural relationships differ significantly across clusters. In the technology leaders cluster, technology and service speed are the main drivers of ambidextrous marketing, and these companies exhibit the highest ability to transform innovation into value creation and desirable financial and social outcomes. In the structured customer-oriented cluster, organizational culture and structural features play pivotal roles, with human relations and organizational cohesion contributing most to the enhancement of ambidextrous marketing. In the resource-constrained cluster, the negative effects of formal structures and environmental conditions on value creation and knowledge management are pronounced, severely limiting these firms' ability to benefit from ambidextrous marketing capabilities.

Despite these heterogeneities, the multigroup analysis revealed that in all clusters, ambidextrous marketing directly and indirectly—through value creation and knowledge management—exerts a positive and significant effect on financial and social outcomes. This demonstrates that ambidextrous marketing, as a core organizational capability, can play a decisive role in improving the performance of railway companies regardless of environmental constraints or resource limitations. In other words, the main differences between clusters lie in the *intensity* of input variable effects

rather than in the *existence* of the fundamental relationships between ambidextrous marketing and final outcomes.

4. Discussion and Conclusion

The findings of this study, which clustered Iranian railway transportation companies based on ambidextrous marketing dimensions, revealed a multifaceted and heterogeneous structure within the industry. The analysis identified three distinct clusters—*technology leaders*, *structured customer-oriented firms*, and *resource-constrained companies*—each characterized by unique marketing, cultural, and technological attributes. These clusters demonstrated significant variations in how marketing ambidexterity (AMX) operates and influences value creation, knowledge management, and financial and social outcomes. The multigroup structural equation modeling results showed that, while the intensity of relationships differed across clusters, ambidextrous marketing consistently had a significant and positive effect on organizational outcomes through value creation and knowledge management. This confirms the robustness of the ambidexterity model as a universal mechanism for achieving both adaptive innovation and sustainable performance in the Iranian railway sector.

The identification of *technology leaders* as the most dynamic and performance-oriented cluster aligns with prior research emphasizing the role of technological factors and

service speed as fundamental enablers of ambidextrous capability. Companies in this cluster achieved high levels of innovation and responsiveness by integrating technology-driven efficiency with market-oriented exploration. This observation supports the notion that dual capabilities—specifically technological agility and market sensing—are essential antecedents of ambidextrous innovation (Hakimi et al., 2023). Similarly, He et al. (He et al., 2021) confirmed that ambidextrous marketing capabilities significantly enhance exploratory and exploitative market-based innovation, resulting in superior innovation performance. In this context, the technological modernization efforts in the Iranian railway industry reflect the same logic: firms capable of combining digital transformation, service quality improvement, and rapid customer response demonstrate a superior ability to balance exploration and exploitation.

The prominence of *structured customer-oriented firms* in the second cluster underscores the importance of organizational culture and social capital as mediating forces in the development of ambidextrous marketing. These firms rely less on technological advantages and more on intangible assets such as interpersonal relationships, internal coherence, and customer engagement. The results revealed that cultural cohesion and structured routines facilitate knowledge sharing and collaborative problem-solving, which in turn enable ambidextrous performance. This finding is consistent with Shahriyari and Jahanshahi (Shahriyari & Jahanshahi, 2021), who argued that dual marketing capability mediates the relationship between market knowledge development and intellectual capital, improving overall organizational performance. Similarly, Dezi et al. (Dezi et al., 2019) emphasized that knowledge management and external embeddedness act as critical antecedents of ambidexterity, allowing firms to exploit internal know-how while exploring new market opportunities. In this cluster, the combination of structured processes and human-centered culture forms a contextual ambidexterity environment, consistent with Gibson and Birkinshaw's model of simultaneous alignment and adaptability (Gibson & Birkinshaw, 2004).

Conversely, the *resource-constrained cluster* displayed the lowest ambidextrous capability and the weakest structural relationships between the model variables. These companies were hindered by limited financial resources, insufficient technological infrastructure, and rigid hierarchical systems. As a result, the negative influence of organizational structure and environmental pressures on value creation and knowledge management was more

pronounced. This pattern aligns with findings from Dolz et al. (Dolz et al., 2019), who demonstrated that firms lacking top management support or flexible ownership structures struggle to sustain ambidexterity during economic crises. The Iranian railway industry's systemic challenges—such as bureaucratic rigidity, outdated regulations, and limited managerial autonomy—further constrain innovation and learning. Majidi et al. (Majidi et al., 2017) previously highlighted that the lack of strategic flexibility and innovation-oriented governance in the railway sector prevents the realization of long-term development strategies. Therefore, this cluster reflects the structural and institutional barriers that impede ambidextrous development in resource-limited organizations.

Despite these variations, the consistent positive effect of ambidextrous marketing on financial and social outcomes across all clusters highlights the universality of AMX as a core organizational capability. The model confirmed that ambidextrous marketing influences outcomes primarily through two mediating mechanisms—*value creation* and *knowledge management*. This finding corroborates prior studies indicating that ambidextrous firms derive competitive advantage by integrating knowledge exploration and exploitation processes (Dezi et al., 2019). By converting market information into actionable strategies and value propositions, these organizations create both economic and social benefits. Similarly, Christofi et al. (Christofi et al., 2021) emphasized that micro-foundational ambidexterity, grounded in knowledge sharing and cross-functional integration, underpins sustainable performance in multinational enterprises. The Iranian railway companies that demonstrated strong knowledge management practices and customer-driven value creation therefore replicated this micro-foundational logic, validating ambidexterity theory in a developing-economy context.

The study also revealed that organizational culture plays a critical role in sustaining ambidextrous marketing. The mediating influence of culture was particularly evident in structured customer-oriented firms, where supportive climates of trust, learning, and communication enabled simultaneous pursuit of exploration and exploitation. This observation resonates with Kassotaki's (Kassotaki, 2019) findings on ambidextrous leadership in high-technology organizations, which showed that leaders who foster psychological safety and open communication encourage teams to innovate while maintaining operational control. In the Iranian railway sector, cultural inertia and hierarchical norms often inhibit such behaviors; however, companies that

nurtured collaborative cultures were able to overcome structural rigidity and achieve superior ambidexterity.

Moreover, the results demonstrated the moderating role of environmental dynamism and market conditions in shaping the pathways between variables. The differential intensity of effects observed across clusters suggests that environmental uncertainty amplifies the importance of dual capabilities. Firms in technologically volatile environments, such as the *technology leader* cluster, benefited more from exploiting digital tools and market data, reflecting March's (March, 1991) theoretical proposition that exploration becomes critical under uncertainty. Conversely, stable or resource-constrained environments reinforced exploitation-oriented behaviors, echoing Gibson and Birkinshaw's (Gibson & Birkinshaw, 2004) view that contextual ambidexterity must adapt to environmental demands. Thus, Iranian railway firms require dynamic alignment between their environmental context, resource base, and marketing orientation to sustain competitiveness.

The role of external relationships and partnerships also emerged as a pivotal factor influencing ambidextrous performance. Firms embedded in external networks leveraged collaborative learning and market feedback mechanisms to enhance their innovation and adaptability. This finding echoes the work of Aripin et al. (Aripin et al., 2024), who found that integrating internal marketing capabilities with external market information systems significantly improves product innovation outcomes. Similarly, Dezi et al. (Dezi et al., 2019) demonstrated that external embeddedness strengthens knowledge flow, which fuels ambidextrous learning. For Iranian railway companies, collaboration with technology providers, logistics partners, and regional stakeholders can compensate for internal capability gaps and promote both operational efficiency and exploratory innovation.

The integration of ambidexterity and dynamic capabilities also offers a coherent explanation for the observed results. Firms in the *technology leader* cluster appear to have internalized dynamic capabilities—sensing, seizing, and transforming—that align with their dual marketing orientation. This dynamic alignment allows them to adapt rapidly to changes in customer demand and technological shifts, sustaining innovation-based competitiveness (Christofi et al., 2021). Conversely, *resource-constrained* firms exhibit weak dynamic capability integration, relying predominantly on reactive strategies that limit strategic renewal. This asymmetry supports the findings of Hakimi et al. (Hakimi et al., 2023), who

emphasized that innovation-oriented ambidexterity requires continuous capability reconfiguration supported by knowledge systems and leadership commitment.

In the broader policy context, these findings reinforce the need for differentiated strategic planning within the Iranian railway industry. Nasr Azadani et al. (Nasr Azadani & Colleagues, 2015) underscored the importance of aligning strategic documents with organizational reforms to ensure the development of the railway sector by 2025. However, without fostering ambidextrous marketing systems that integrate technological and cultural innovations, policy measures remain insufficient. The evidence from this study suggests that technological investments must be complemented by managerial development, knowledge-sharing platforms, and customer engagement programs. These findings also align with Ahmadi (Ahmadi, 2019), who noted that sustainable growth in the rail industry depends on harmonizing operational improvements with innovation and market responsiveness.

Furthermore, the empirical validation of the PLS-SEM model demonstrates the methodological strength of the ambidexterity framework in capturing complex causal relationships among latent variables. The use of discriminant validity assessments and multigroup analysis follows the methodological rigor proposed by Henseler et al. (Henseler et al., 2015), ensuring robust measurement and comparison across heterogeneous organizational clusters. This methodological integration strengthens the credibility of the results and provides a replicable analytical framework for future studies in other transportation or service industries.

From an international perspective, the results of this research parallel findings from other emerging economies where ambidextrous marketing serves as a mechanism for strategic renewal. For instance, in the Vietnamese transportation sector, ambidexterity facilitates adaptation to electrification and green mobility initiatives (Huu & Ngoc, 2021), while in Iraq's retail and service industries, ambidextrous marketing mediates multicultural marketing and business recovery processes (Al-Janabi et al., 2024). These parallels confirm that ambidexterity transcends industrial and national boundaries, functioning as a universal strategic logic for organizations operating under volatility and transformation.

In sum, the present study contributes to ambidexterity theory by demonstrating that marketing ambidexterity operates as a multi-dimensional, context-sensitive capability that drives value creation through both technological and cultural pathways. The coexistence of exploratory and

exploitative orientations was found to be contingent upon organizational culture, leadership structure, and environmental context, consistent with the dynamic and systemic nature of ambidexterity. By empirically validating these relationships in a strategically significant yet under-researched industry, the study provides both theoretical enrichment and practical insights into how ambidextrous marketing can enhance performance and sustainability in complex service systems such as railway transportation.

Although this study provides novel insights into ambidextrous marketing in the Iranian railway industry, several limitations should be acknowledged. First, the research design relied on cross-sectional data, which restricts the ability to infer causality between constructs. Longitudinal data would allow for examining how ambidexterity evolves over time as firms adapt to environmental changes. Second, the study's reliance on self-reported questionnaire data introduces potential bias related to social desirability or respondent perception. Triangulating quantitative findings with qualitative interviews or secondary performance data could strengthen validity. Third, while the sample covered a substantial portion of active railway companies, the relatively small population of the industry limits generalizability beyond the national context. Fourth, the focus on marketing ambidexterity excluded other organizational ambidexterity dimensions such as technological or strategic ambidexterity, which may also shape performance. Finally, the study did not account for the role of institutional or policy-level variables that could moderate the relationship between ambidexterity and outcomes.

Future studies should extend this research by employing longitudinal and mixed-method designs to capture the dynamic evolution of ambidextrous marketing capabilities. Comparative studies across different transportation sectors—such as aviation, maritime, or logistics—would also help identify sector-specific determinants of ambidexterity. Researchers may examine the moderating roles of institutional frameworks, digital transformation policies, and environmental sustainability initiatives on the ambidexterity–performance relationship. Moreover, future research could integrate multi-level analyses exploring how individual managerial cognition and team-level learning processes contribute to firm-level ambidexterity. Advanced modeling techniques, including hierarchical SEM and system dynamics, could be used to assess the interplay between organizational culture, leadership, and innovation ecosystems. Lastly, cross-country comparisons between

emerging and developed economies could clarify how contextual constraints influence the operationalization of ambidextrous marketing capabilities.

For practitioners, the findings underscore the importance of adopting differentiated strategies tailored to organizational cluster characteristics. Technology leaders should focus on maintaining dynamic capabilities and leveraging digital transformation for continual innovation. Structured customer-oriented firms need to strengthen organizational culture, empower employees, and build robust knowledge management systems to sustain adaptive marketing. Resource-constrained companies must prioritize strategic partnerships, human capital development, and gradual digital integration to overcome capability gaps. Managers should institutionalize learning systems, foster ambidextrous leadership styles, and promote interdepartmental collaboration to align exploration and exploitation efforts. Policymakers, meanwhile, should design supportive frameworks that encourage innovation, reduce bureaucratic barriers, and facilitate access to technological resources and training. By aligning strategy, structure, and culture, railway organizations can translate ambidextrous marketing capabilities into sustainable competitive advantage and sectoral modernization.

Authors' Contributions

Authors contributed equally to this article.

Declaration

In order to correct and improve the academic writing of our paper, we have used the language model ChatGPT.

Transparency Statement

Data are available for research purposes upon reasonable request to the corresponding author.

Acknowledgments

We would like to express our gratitude to all individuals helped us to do the project.

Declaration of Interest

The authors report no conflict of interest.

Funding

According to the authors, this article has no financial support.

Ethics Considerations

In this research, ethical standards including obtaining informed consent, ensuring privacy and confidentiality were considered.

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