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The effect of multiple-network structure on divergent creativity of enterprise industrial cluster: The mediator of organizational resilience the moderator of organizational legitimacy

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Abstract: In the context of advancing economic globalization and regional integration, industrial clusters not only confer competitive advantages and foster innovation but also enable firms to gain excess profits through knowledge spillovers. This study investigates the impact of multi-network structures on the divergent creativity of firms within these clusters. Drawing on survey data from 926 valid questionnaires, we employ structural equation modeling for our analysis. The results indicate that a multi-network structure positively influences the divergent creativity of firms. Furthermore, organizational resilience mediates this relationship, while organizational legitimacy acts as a positive moderator, strengthening the effect. This study explores the synergistic effect of multi-network structures and organizational resilience on divergent creativity within the industrial cluster context, thereby extending the theoretical boundaries of social network theory and industrial cluster theory. By innovatively introducing organizational legitimacy as a moderating variable, this research identifies its role as a key boundary condition in the interplay between multi-network structures, organizational resilience, and divergent creativity, thus offering new avenues for future research.

Keywords: *Divergent creativity, Multi-network structure, Organizational legitimacy, Organizational resilience.*

1. Introduction

In today's globalized and fiercely competitive business environment, the phenomenon of industrial clusters has become increasingly significant, exerting a profound impact on regional economic development and national competitive advantage [1]. However, within the process of industrial clustering, issues such as inter-organizational management, innovation, and legitimacy have grown more complex, making the internal and external relationships of clusters a critical topic in strategic and organizational management research [2, 3].

A multi-network structure provides firms with diverse channels for resources, technology, and information through its management and institutional networks. Cao et al. and Punt et al. argued that by offering efficient information exchange channels and resource-sharing mechanisms, the multi-network structure significantly fosters corporate divergent creativity. The management network not only facilitates knowledge sharing, learning, and renewal among firms but also drives the cross-fertilization of knowledge and information, thereby boosting firms' excess profits [4, 5]. Furthermore, by interacting with different enterprises, firms can access a diversified system of knowledge and technology exchange, which in turn sparks new ideas and solutions [6, 7]. The institutional network, through standardized information flow mechanisms (e.g., industry associations, technical standard-setting), promotes the systematic integration of information. This not only enhances a firm's innovation capabilities but also provides a rich foundation for its divergent creativity [8]. Previous research, often grounded in industrial cluster theory, has discussed the agglomeration effects of enterprise clusters,

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focusing primarily on the complementary, interactive, and cooperative relationships among firms within a cluster, as well as firms' motivations for joining them. Firms enter clusters not only to gain passive benefits but also to derive external economies from numerous interconnected enterprises [3]. However, there is limited research on how, in a dynamic competitive environment, network management and organizational legitimacy within clusters influence organizational resilience and, in turn, affect the divergent creativity of firms. Therefore, investigating the impact of multi-network structure on the divergent creativity of clustered firms is one of the primary objectives of this study.

To further explore the relationship between multi-network structure and the divergent creativity of firms within clusters and its underlying mechanisms, this paper, grounded in social network theory, investigates how multi-network structure affects divergent creativity through organizational resilience. Organizational resilience is defined as the ability of an organization to anticipate, prepare for, respond to, and adapt to environmental changes in the face of pressure and challenges, allowing the organization to survive and prosper while adjusting and optimizing its strategies and behaviors [9]. This is particularly relevant in the current environment of tariff barriers and trade obstacles erected by nations to protect their domestic industries. Organizational resilience emphasizes a firm's learning and adaptive capacities. In a competitive cluster environment, firms acquire diverse information, knowledge, and experience through interactions with different enterprises via the multi-network structure. Organizational resilience ensures that firms can internalize this knowledge and apply it to innovation practices, thereby stimulating divergent creativity [10-12]. The mediating role of organizational resilience in the relationship between multi-network structure and the divergent creativity of clustered firms has been underexplored, representing a research gap that this study aims to address. Thus, examining this mediating effect is the second objective of this paper.

Organizational legitimacy refers to the degree to which an organization's strategies, structures, goals, and very existence are recognized and supported within its cluster [13, 14]. Organizational legitimacy enhances trust, cooperation, reciprocity, and complementarity within a firm's collaborative network, enabling resilience capabilities (such as rapid adaptation to market changes) to be more efficiently transformed into creativity through knowledge sharing and joint development [15]. Past studies have explored how to enhance organizational performance and competitiveness in the context of industrial clusters [3, 14, 16, 17]. However, research on how organizational resilience and organizational legitimacy simultaneously affect the divergent creativity of clustered firms is limited. Through an in-depth investigation of the relationships between multi-network structure, organizational resilience, and the divergent creativity of clustered firms, as well as the moderating role of organizational legitimacy, this study poses the following questions: How does a multi-network structure affect the divergent creativity of clustered firms? How does the management network influence divergent creativity? How does the institutional network influence divergent creativity? How does a multi-network structure affect organizational resilience? How does organizational resilience affect divergent creativity? Does organizational resilience play a mediating role? How does organizational legitimacy affect the relationship between multi-network structure and divergent creativity? How does organizational legitimacy affect the relationship between organizational resilience and divergent creativity?

This study combines multi-network structure with organizational resilience to analyze their comprehensive impact on the divergent creativity of firms in an industrial cluster environment, thereby extending the theories of multi-network structure and industrial clusters. Concurrently, it extends the literature on the moderating role of organizational legitimacy in the relationships between multi-network structure and divergent creativity, and between organizational resilience and divergent creativity, providing new theoretical insights for researchers. Moreover, it reveals the boundary conditions of organizational legitimacy in the interplay between multi-network structure, organizational resilience, and divergent creativity.

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2. Literature Review and Hypothesis

2.1. Social Network Theory (SNT)

Social Network Theory, as proposed by Wellman and Berkowitz [18] posits that a "social network is a series of relationships and ties formed by social actors." It views a network as a set of social ties or social relations connecting actors. Ahuja found that a firm's network position and structure have a significant impact on its innovation performance. Similarly, the divergent creativity of firms within a cluster can be enhanced through access to resources, technology, information, and knowledge via nodal relationships in the social network [19]. A firm's position in the network structure (defined by network density, configuration, position, and centrality) allows it to secure an important status and control the resources needed by other members of the network [20]. By applying social network theory and methods, it is possible to gain a deeper understanding of how firms in industrial clusters leverage domestic and international network relationships to acquire more connections, resources, and cooperation opportunities, thereby enhancing their competitiveness and creativity.

2.2. Multi-network Structure and Intra-cluster Divergent Creativity

A Multi-Network Structure is a theoretical framework for analyzing and describing multiple interconnected network structures in complex systems. It forms a multi-dimensional network system through interconnected nodes and relationships [21, 22]. Intra-cluster Divergent Creativity refers to the enhancement of innovation outcomes by firms within the same industrial cluster through mutual cooperation, competition, and the sharing of technical knowledge D'Alise, et al. [23]. Granovetter [24] argument on embeddedness, which emphasizes that economic behavior is embedded in social relationship networks, also provides a theoretical foundation for the role of multi-network structures in divergent creativity [24]. Villasalero [25] pointed out that as firms develop, the optimization and restructuring of multi-network structures can continuously stimulate their divergent creativity and drive sustained innovation [25].

Research by Ahuja [19]; Burt [26] and Gentile-Lüdecke, et al. [27] found that the dual embeddedness in management and institutional networks can significantly enhance a firm's innovation capabilities and its ability to respond quickly to the market, indirectly promoting divergent creativity [26, 27]. Dongling, et al. [28] explored how inter-organizational cooperation fosters knowledge sharing and innovation [28]. Digital platforms, by providing efficient channels for information exchange and resource sharing, significantly amplify the positive effect of multi-network structures on corporate divergent creativity. A highly centralized management network combined with close institutional network ties helps firms adopt more open and flexible innovation strategies, thereby enhancing divergent creativity [4, 5, 29]. In summary, a multi-network structure positively influences a firm's divergent creativity by providing resource and information diversity, promoting the cross-fertilization of knowledge and technology, enhancing social capital, and building an innovation ecosystem. Therefore, we propose the following hypothesis:

H_1: Multi-network structure has a positive effect on the divergent creativity of intra-cluster firms.

The management network is defined as the process by which "organizations, through formal and informal relationships, connect externally to integrate dispersed resources and capabilities to cope with rapid environmental changes and achieve strategic goals" Gulati [30]. Chen, et al. [3] noted that bridge ties can provide firms with a competitive advantage by enhancing their innovation capabilities through the connection of knowledge from different domains Chen, et al. [3]. Tsai, et al. [31] indicated that internal organizational networks not only promote knowledge transfer but also impact innovation performance Tsai [6]; Sultana and Turkina [7] and Lavie [32]. Burt and Powell et al. emphasized the importance of network position and absorptive capacity; they explored how social capital and networks facilitate knowledge transfer, particularly how management networks strengthen learning opportunities between firms, and analyzed how inter-firm connections constitute a competitive advantage, especially through resource sharing and cooperative networks that promote innovation Burt [26]; Gentile-Lüdecke, et al. [27]; Dongling, et al. [28]; Lin, et al. [29]; Gulati [30]; Lavie [32] and Powell, et al.

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[33]. Lee [34] aimed to investigate the relationship between transformational leadership, followers' innovative behavior, commitment to change, and organizational support for creativity [34]. It was found that the impact of transformational leadership on followers' innovative behavior was stronger in organizations with lower support for creativity compared to those with high support. In conclusion, the management network plays a positive role in enhancing a firm's divergent creativity by facilitating inter-firm knowledge sharing, transfer, learning, and rapid adaptation to market changes, thereby providing firms with access to new information and methods. Therefore, we propose the following hypothesis:

H_{1a} The management network has a positive effect on the divergent creativity of intra-cluster firms.

The institutional network refers to the mechanism by which institutions are disseminated and legitimized through social relationship networks, where actors are both constrained by institutions and reshape institutional rules through interaction [35]. Furthermore, the institutional network, through standardized knowledge flow mechanisms (e.g., industry associations, technical standard-setting), facilitates the systematic integration of knowledge. This not only enhances a firm's innovation capabilities but also provides a rich knowledge base for its divergent creativity O'Mahony and Bechky [8]. Maurer, et al. [36] studied how internal social capital promotes knowledge transfer and innovation performance, emphasizing the role of institutional networks in facilitating knowledge sharing Maurer, et al. [36]. Battilana and Lee [37] examined how social enterprises combine business models with social goals, demonstrating the influence of institutional relationships on a firm's innovation methods Battilana and Lee [37]. Brown and Mason [38] critically reviewed and conceptualized entrepreneurial ecosystems, discussing how government policies and resources support entrepreneurial activities and SME innovation Brown and Mason [38]. Cumming and Groh [39] explored themes and future directions in entrepreneurial finance, including how governments support start-ups and SMEs' innovation through funding and other resources [39]. In summary, the institutional network plays a vital role in promoting shared norms, strengthening cooperative networks, and facilitating knowledge flows, thereby enhancing corporate divergent creativity. Therefore, we propose the following hypothesis:

H_{1b} The institutional network has a positive effect on the divergent creativity of intra-cluster firms.

2.3. Organizational Resilience, Multi-network Structure, and Intra-cluster Divergent Creativity

Organizational resilience refers to an organization's ability to maintain its basic structure and function while adjusting and optimizing its strategies and behaviors to ensure its survival and development in the face of pressure and challenges Annarelli and Nonino [9]. Uzzi [40] revealed the competitive advantages of firms embedded in social relationship networks, emphasizing how these network relationships provide firms with resources and information, thereby enhancing their resilience Uzzi [40]. Obstfeld [41]; Borgatti and Halgin [42] and Xie, et al. [43] provide a comprehensive overview of network theory, exploring how cooperative networks and structural holes promote innovation, which is a crucial component of organizational resilience, especially in terms of adaptability and recovery. They discuss how multi-network models affect an organization's resource acquisition and adaptive capacity, emphasizing the importance of these models in promoting innovation and resource flow, and how position and connections within the network influence resource flow. They point out that a multi-network structure enhances an organization's adaptability and resilience by connecting different flows of information and resources [41-43].

Williams et al. and Sarta et al. reviewed the formation and dynamics of organizational networks, particularly how multi-network structures improve an organization's adaptability to environmental changes. They proposed that multi-network structures enhance adaptability, as firms establish and maintain cooperative networks to cope with, recover from, and grow from adversity Williams, et al. [44] and Sarta, et al. [45]. Liu, et al. [46] and He, et al. [47] found that organizations need a hybrid portfolio to simultaneously support the competing strategic demands for agility and resilience and used the Analytic Network Process (ANP) to analyze the importance of factors influencing organizational

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resilience [46, 47]. From this, it is evident that a multi-network structure has a significant impact on enhancing organizational resilience, especially in terms of resource acquisition, knowledge sharing, and cooperative support. By deeply understanding and effectively managing their diverse network relationships, organizations can better adapt to environmental changes and recover and grow from challenges. Therefore, we propose the following hypothesis:

H_2: Multi-network structure has a positive effect on organizational resilience.

Bhamra, et al. [48]; Linnenluecke [49] and Heredia, et al. [50] argue that organizational resilience can promote adaptation and innovation when firms face supply chain disruptions, and it also enhances an organization's adaptive capacity and its ability to explore unknown domains. Organizational resilience also contributes to promoting adaptation to environmental changes and innovation Bhamra, et al. [48]; Linnenluecke [49] and Heredia, et al. [50]. Ortiz - De - Mandojana and Bansal [51] pointed out that organizational resilience, by establishing and maintaining stable cooperative relationships, enhances trust and mutual assistance within the network, creating conditions for jointly exploring new areas and solutions Ortiz - De - Mandojana and Bansal [51]. Williams, et al. [44] and Duchek [52] emphasized the role of adaptability in promoting firms' exploration of new domains and innovation, with organizational resilience enhancing a firm's adaptability and innovation capacity to cope with uncertainty and change Williams, et al. [44]; Sarta, et al. [45]; Liu, et al. [46]; He, et al. [47]; Bhamra, et al. [48]; Linnenluecke [49]; Heredia, et al. [50]; Ortiz - De - Mandojana and Bansal [51] and Duchek [52]. Heredia, et al. [50] found that strategic human resource management strengthens the importance of organizational resilience in promoting corporate innovation and adaptability by developing organizational resilience capabilities [50]. It is thus clear that organizational resilience is crucial for promoting the divergent creativity of firms within a cluster. By encouraging innovative thinking, enhancing adaptability, and promoting learning and growth, it provides support and impetus for divergent creativity, leading to success in a highly competitive market. Therefore, we propose the following hypothesis:

H_3: Organizational resilience has a positive effect on the divergent creativity of intra-cluster firms.

Organizational resilience enables firms to maintain stability during crises or uncertainty and to identify new innovation opportunities through rapid response Williams, et al. [44]; Sarta, et al. [45]; Liu, et al. [46]; He, et al. [47]; Bhamra, et al. [48]; Linnenluecke [49]; Heredia, et al. [50]; Ortiz - De - Mandojana and Bansal [51] and Duchek [52]. Cameron and Dutton [53] explored how organizations can enhance their recovery and adaptability by building resilience, which provides a foundation for promoting innovation and divergent creativity Cameron and Dutton [53]. Ortiz - De - Mandojana and Bansal [51] and Lengnick-Hall, et al. [54] noted that strategic human resource management is conducive to building organizational resilience capabilities, and sustainable business practices enhance long-term organizational resilience, especially in resource allocation and utilization to support innovation activities and sustainable development [51-54]. Concurrently, Adger [10] stated that organizational resilience, by establishing and maintaining stable cooperative relationships, enhances trust and mutual assistance among firms in the network, creating conditions for exploring new domains and solutions together [10]. Organizational resilience emphasizes a firm's learning and adaptive capacity. In a multi-network structure, firms acquire diverse knowledge and experience through interactions with different nodes, and organizational resilience ensures that firms can internalize this knowledge and apply it to innovation practices, thereby stimulating divergent creativity [11, 12]. Organizational resilience not only reflects a firm's ability to recover from adversity, pressure, or crisis but also embodies its capacity to adapt to environmental changes and to discover and exploit new opportunities. In the context of a multi-network model, organizational resilience facilitates the flow of resources, knowledge, and information, strengthens collaboration and learning among firms, and thus creates favorable conditions for the exercise of divergent creativity. Therefore, we propose the following hypothesis:

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H_4. Organizational resilience mediates the relationship between multi-network structure and the divergent creativity of intra-cluster firms.

2.4. The Moderating Role of Organizational Legitimacy

Organizational legitimacy enhances a firm's ability to acquire external resources (such as funding, technology, and policy support) during a crisis and to gain the support and recognition of other members in the cluster [14]. Organizational resilience also determines how a firm integrates these resources to support innovation Dacin, et al. [55] and Lv, et al. [56]. Suchman [13] emphasized the central role of organizational legitimacy in supporting an organization's adaptability and innovation capability Suchman [13] while Deephouse and Carter [57] further explored the distinction between legitimacy and reputation and how they jointly affect organizational behavior and performance, providing a theoretical basis for understanding the moderating role of legitimacy in organizational resilience and innovation capability [57]. Organizational legitimacy is important because it strengthens relationships with external stakeholders and their willingness to cooperate and engage with the organization. This cooperation not only promotes cross-boundary knowledge sharing but also makes it possible to explore new domains. Organizational legitimacy makes it easier for firms to coordinate with institutional networks (such as industry associations and policy bodies) and to leverage their resilience capabilities to respond to external changes, transforming recognition and support into innovation opportunities DesJardine, et al. [58] and Al Balushi [59]. Shan and Tian [60] highlighted the role of entrepreneurs in shaping market boundaries and building organizational legitimacy to gain power, emphasizing the role of legitimacy in promoting the exploration of new domains and cross-boundary cooperation [60]. Highly legitimate organizations can more easily obtain external support when facing crises and challenges, which strengthens their resilience, allowing them to recover more quickly from adversity and to learn and innovate from the experience. In summary, organizational legitimacy enhances an organization's response capacity when facing challenges by improving its reputation and trustworthiness within its ecosystem. It not only provides necessary external support and cooperation opportunities but also creates an environment conducive to innovation and exploration. Therefore, we propose the following hypothesis:

H_5. Organizational legitimacy positively moderates the relationship between organizational resilience and the divergent creativity of intra-cluster firms.

Organizational legitimacy, as the cornerstone of trust and recognition between an organization and its external stakeholders, significantly promotes a firm's interactions, cooperation, and acquisition of resources and knowledge within a multi-network structure. Gulati and Wu et al. pointed out that network position has a significant impact on a firm's learning, resource acquisition, and ability to form alliances with suppliers, customers, and research institutions, with organizational legitimacy being a key factor in establishing these cooperative relationships [61, 62]. This indicates that organizational legitimacy is not only about reputation and image but is also a crucial prerequisite for acquiring resources and building partnerships within the network. Dacin, et al. [55] and Gordo Molina, et al. [63] emphasized the importance of organizational legitimacy for the growth of new ventures, particularly its role in acquiring key resources such as capital, talent, and information. They further revealed how legitimacy affects a firm's willingness and ability to cooperate within a multi-network model, noting that highly legitimate firms are more sought-after in networks and more likely to establish cooperative relationships, thereby gaining more resources and information [55-62]. This suggests that legitimacy is not only a tool for established firms to maintain their network status but also a key for new ventures to enter markets, acquire resources, and achieve rapid growth. Quinn, et al. [64] discussed the importance of companies using different strategies to maintain their legitimacy and analyzed the impact of these strategies on enhancing corporate reputation and gaining the support of key stakeholders [64]. This indicates that maintaining organizational legitimacy is an ongoing process that requires continuous effort from the firm to preserve its acceptance and recognition within the network. In summary, organizational legitimacy not only helps firms better integrate into their clusters

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and networks but also enhances the quality and effectiveness of these network relationships. By improving their legitimacy, firms can access more opportunities, resources, and information, and build broader cooperative relationships, thereby promoting the development of divergent creativity. Therefore, we propose the following hypothesis:

H₆ Organizational legitimacy positively moderates the relationship between multi-network structure and the divergent creativity of intra-cluster firms.

Based on the above literature discussion and research hypotheses, we propose the research framework illustrated in Figure 1.

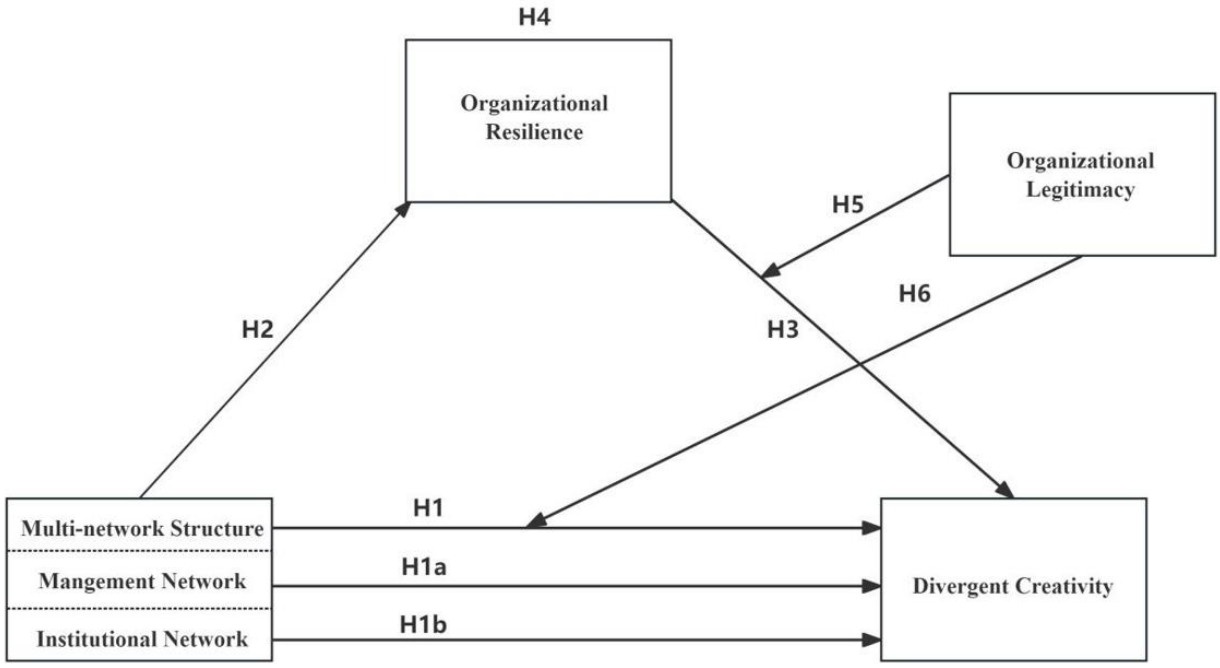

Figure 1.
Research Framework Diagram.

3. Data Collection and Sample

3.1. Sample Procurement

This paper primarily investigates the relationships between multi-network structure, organizational resilience, and the divergent creativity of intra-cluster firms. This study targets high-tech enterprises within industrial clusters. The study population consists of high-tech enterprises located in national-level economic development zones (high-tech zones) in five representative regions of China. To represent the eastern, western, southern, northern, and central regions, the provinces with the most advanced economic development were selected: Jiangsu, Sichuan, Guangdong, Henan, and Hunan, respectively. To ensure the representativeness of the sample, a stratified random sampling method was employed. The sample was drawn from the national-level economic development zones in these five provinces. Questionnaires were distributed in proportion to the population size of each zone: 400 in Jiangsu, 100 in Sichuan, 400 in Guangdong, 150 in Henan, and 150 in Hunan, for a total of 1,200 questionnaires. Data were systematically collected from November 10, 2024, to February 10, 2025 (see Table 1).

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Table 1.
Survey Statistics for National Economic and Technological Development Zones (High-tech Zones) in Five Provinces.

Province	Name of Economic Development Zone (High-tech Zone)	High-tech Industry Category	Questionnaires Distributed	Questionnaires Collected	Survey Date
JS			**400**	**376**	
	Nanjing	Electronic Information, Aerospace, High-end Equipment Manufacturing and New Material R&D	60	57	January 26-27, 2025
	Jiangning	Biomedicine, High-tech Services, Innovative Medical and Technology Services	40	38	January 26-27, 2025
	Suzhou Industrial Park	Electronic Information, Biomedicine, Nanotechnology, Artificial Intelligence	100	96	February 5-6, 2025
	Kunshan	Electronic Information Manufacturing, Advanced Manufacturing and Automation	80	76	February 7-8, 2025
	Zhangjiagang	New Materials, New Energy and Energy Conservation Technology, High-end Equipment Manufacturing	40	36	February 7-8, 2025
	Changshu	Automotive Parts Manufacturing, Advanced Manufacturing and Automation, Intelligent Equipment	40	37	February 7-8, 2025
	Taicang Port	High-end Equipment Manufacturing, New Energy	20	19	February 5-6, 2025
	Huishan	High-end Equipment Manufacturing, New Materials, Energy-saving and Environmental Protection Technology	20	17	January 26-27, 2025
SC			**100**	**93**	
	Chengdu	Electronic Information, High-tech Services, Biomedicine and Aerospace Technology	30	29	January 20-21, 2025

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Table 1.
Survey Statistics for National Economic and Technological Development Zones (High-tech Zones) in Five Provinces (Continue1).

Province	Name of Economic Development Zone (High-tech Zone)	High-tech Industry Category	Questionnaires Distributed	Questionnaires Collected	Survey Date
	Chengdu International Railway Port	High-tech Services, Advanced Manufacturing and Automation, New Energy Technology Application	10	9	January 20-21, 2025
	Deyang	Advanced Manufacturing and Automation, New Materials, New Energy Equipment Manufacturing	10	9	January 20-21, 2025
	Mianyang	Electronic Information, Aerospace, New Energy and Energy Conservation Technology	20	19	January 20-21, 2025
	Yibin Lingang	New Energy and Energy Conservation, Resources and Environment, Advanced Manufacturing	10	10	January 24, 2025
	Neijiang	New Materials, Advanced Manufacturing, Supporting Industries for Electronic Information	10	8	January 23, 2025
	Neijiang High-tech	Biomedicine, High-tech Services, Modern Agricultural Technology R&D	10	9	January 23, 2025
GD			**400**	**373**	
	Guangzhou	Electronic Information, Automobile Manufacturing, Biomedicine, High-tech Services	100	93	January 7-8, 2025
	Huadu	Advanced Manufacturing and Automation, New Energy and Energy Conservation, New Materials	10	9	January 7-8, 2025
	Foshan	Advanced Manufacturing, New Materials, New Energy, Resources and Environment	80	75	January 7-8, 2025

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Table 1.
Survey Statistics for National Economic and Technological Development Zones (High-tech Zones) in Five Provinces (Continue 2).

Province	Name of Economic Development Zone (High-tech Zone)	High-tech Industry Category	Questionnaires Distributed	Questionnaires Collected	Survey Date
	Shenzhen	Electronic Information, Biomedicine, Artificial Intelligence, Digital Economy	200	187	January 9-10, 2025
	Zhuhai	High-end Equipment Manufacturing, New Energy and Energy Conservation, Biomedicine, High-tech Services	10	9	January 13, 2025
HeN			**150**	**139**	
	Zhengzhou Economic Development Zone	Advanced Manufacturing and Automation, Electronic Information, New Energy Equipment	20	19	December 17-19, 2024
	Zhengzhou High-tech	Electronic Information, Biomedicine, High-tech Services	40	37	December 17-19, 2024
	Zhengdong New Area	High-tech Services, New Energy and Energy Conservation, Digital Cultural and Creative Industries	30	28	December 17-19, 2024
	Zhengzhou Airport Economy Zone	Aerospace, Logistics Technology, New Materials	30	27	December 17-19, 2024
	Erqi District	New Materials, Resources and Environment, Advanced Manufacturing	10	10	December 17-19, 2024
	Zhongyuan District	New Energy and Energy Conservation, High-tech Services, Smart Home Manufacturing	10	9	December 17-19, 2024
	Huiji District	Biomedicine, Resources and Environment, Modern Agricultural Technology	10	9	December 17-19, 2024

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Table 1.
Survey Statistics for National Economic and Technological Development Zones (High-tech Zones) in Five Provinces (Continue 3).

Province	Name of Economic Development Zone (High-tech Zone)	High-tech Industry Category	Questionnaires Distributed	Questionnaires Collected	Survey Date
HuN			**150**	**143**	
	Changsha	Electronic Information, Advanced Manufacturing and Automation, Biomedicine, High-tech Services	60	59	December 2-3, 2024
	Liuyang	New Materials, New Energy and Energy Conservation, Biomedicine, Intelligent Upgrade of the Fireworks Industry	20	19	December 2-3, 2024
	Ningxiang	Advanced Manufacturing and Automation, New Materials, New Energy and Energy Conservation, Resources and Environment	20	18	December 2-3, 2024
	Wangchen	Electronic Information, High-tech Services, Aerospace, Intelligent Terminal Manufacturing	10	10	December 2-3, 2024
	Xiangtan	Advanced Manufacturing and Automation, New Materials, Resources and Environment, High-end Equipment Manufacturing	20	19	December 9, 2024
	Changde	Biomedicine, Resources and Environment, Advanced Manufacturing, New Energy	10	9	December 11, 2024
	Loudi	New Materials, Resources and Environment, New Energy and Energy Conservation, Advanced Manufacturing	10	9	December 5, 2024

The survey respondents were senior management personnel, such as CEOs, CFOs, and Deputy General Managers. The primary data collection method was on-site surveys, during which researchers visited the enterprises in the zones, conducted face-to-face interviews with senior executives, explained the research objectives and how to complete the questionnaire, stressed that the results would be used for academic research only, and assured data confidentiality. The questionnaires were collected on the spot. Endorsements from the park administration committees increased the cooperation rate of the executives. Strategies such as on-site explanations by the researchers, immediate checks for the completeness of the scales, and embedding the questionnaire into meeting agendas contributed to a high response and validity rate. A total of 1,200 questionnaires were distributed, and 1,124 were returned. After removing 274 questionnaires deemed invalid (due to missing values, extreme values, and response consistency issues), 926 valid questionnaires remained, resulting in a final valid response rate of 82.38%.

3.2. Measures

To ensure the quality of the measurement items, following He's suggestion, a pilot survey was conducted before the main distribution to perform item analysis, aiming to develop an accurate and culturally appropriate measurement tool to guarantee the accuracy of the results [65]. This study adopted the scale translation and adaptation process outlined by Bullinger, et al. [66]. First, two linguists who had studied in Europe and the US were invited to translate the English scales into Chinese. Then, two doctoral holders in business administration, fluent in both Chinese and English and having studied in the UK, were invited to perform a back-translation procedure. The back-translated

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English version was compared with the original English scale, and discrepancies were discussed and rectified to form the final Chinese scale. This process resulted in the pilot questionnaire for the four variables. A total of 200 pilot questionnaires were distributed, with 154 valid responses returned, for a validity rate of 86.52%. This study used a 7-point Likert scale. Additionally, 10 industry professionals were asked to pre-test the questionnaire to ensure full comprehension of the items.

Multi-network Structure (Independent Variable): This study used a 17-item scale to measure multi-network structure, adopting the management network items developed by Michael and Yukl [67] and the institutional network items developed by Yu, et al. [68]. After Exploratory Factor Analysis (EFA) and reliability tests, the Cronbach's α coefficients for the two dimensions were 0.931 and 0.925, respectively, both greater than 0.70. The Corrected Item-Total Correlation (CITC) values ranged from 0.653 to 0.878, all above 0.4, indicating good reliability. The Kaiser-Meyer-Olkin (KMO) value for the multi-network structure was 0.910 (>0.8), and Bartlett's test of sphericity was significant ($p<0.01$), confirming the suitability of the data for factor analysis. The factor loadings for all items ranged from 0.677 to 0.902, all above 0.6, so no items were deleted.

Organizational Resilience (Mediating Variable): This study used the 16-item organizational resilience scale developed by Zhang and Teng [69]. After EFA and reliability tests, the Cronbach's α coefficients for the three dimensions were 0.941, 0.907, and 0.857, respectively, all greater than 0.70. The CITC values ranged from 0.60 to 0.869, all above 0.4, indicating good reliability. The Kaiser-Meyer-Olkin (KMO) value was 0.906 (>0.8), and Bartlett's test of sphericity was significant ($p<0.01$), confirming the suitability of the data for factor analysis. The factor loadings ranged from 0.706 to 0.890, all above 0.6, so no items were deleted.

Organizational Legitimacy (Moderating Variable): This study used the 6-item organizational legitimacy scale developed by Chen, et al. [3]. The overall Cronbach's α was 0.885 (>0.70). The CITC values ranged from 0.570 to 0.775, all above 0.4, indicating good reliability. The Kaiser-Meyer-Olkin (KMO) value was 0.816 (>0.8), and Bartlett's test of sphericity was significant ($p<0.01$), confirming the suitability of the data for factor analysis. The factor loadings ranged from 0.692 to 0.857, all above 0.6, so no items were deleted.

Intra-cluster Divergent Creativity (Dependent Variable): This study used a 20-item creativity scale based on the divergent creativity scales developed by Guilford [70] and Mumford [71]. The Cronbach's α coefficients for the dimensions were 0.872, 0.946, 0.866, and 0.869, with an overall Cronbach's α of 0.917, all above 0.70. After examining the Cronbach's alpha if item deleted statistics, items DC5 and JM4 were removed as their deletion increased the overall alpha for their respective dimensions. The remaining CITC values ranged from 0.745 to 0.833, all above 0.4, indicating good reliability. The Kaiser-Meyer-Olkin (KMO) value was 0.912 (>0.8), and Bartlett's test of sphericity was significant, confirming the suitability of the data for factor analysis.

After data collection, the sample structure was analyzed, with the results shown in Table 2.

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Table 2.
Analysis of Sample Structural Characteristics.

		Count	Percentage %
Industry Type	Electronic Information	347	37.47%
	Biomedicine and New Pharmaceuticals	57	6.16%
	Aerospace	46	4.97%
	New Materials	62	6.70%
	High-tech Services	163	17.60%
	New Energy and Energy Conservation	44	4.75%
	Resources and Environment	47	5.08%
	Advanced Manufacturing and Automation	160	17.28%
Number of Employees	300 people and below	479	51.73%
	301-500 people	223	24.08%
	501-1000 people	131	14.15%
	1001 people and above	93	10.04%
Capital Amount	10.01 million - 50 million	372	40.17%
	50.01 million - 100 million	257	27.75%
	100.01 million - 500 million	139	15.01%
	500.01 million - 1 billion	109	11.77%
	1.0001 billion and above	49	5.29%
Years of Establishment	6-10 years	178	19.22%
	11-15 years	289	31.21%
	16-20 years	271	29.27%
	21 years and above	188	20.30%

4. Analysis and Results

4.1. Descriptive Statistical Analysis

As shown in Table 3, the absolute skewness values for the measured variables (multi-network structure, organizational resilience, organizational legitimacy, divergent creativity) ranged from 0.344 to 1.036, and the absolute kurtosis values ranged from 0.256 to 1.432, which are within acceptable limits for assuming a normal distribution [72].

Table 3.
Table of Descriptive Statistics of the Sample Data.

	N	Min.	Max.	Mean	Std. Deviation	Skewness	Kurtosis
Divergent Creativity	926	1	7	4.560	1.249	-0.344	-0.718
Multi-network Structure	926	1	7	4.463	1.058	-0.552	-0.352
Organizational Resilience	926	1	7	4.887	1.005	-0.526	0.256
Organizational Legitimacy	926	1	7	4.801	1.112	-1.036	1.432

4.2. Correlation Analysis

The Pearson correlation coefficients in Table 4 show that there are significant correlations ($p<0.05$) among all variables, except for the moderating variable (organizational legitimacy), which was not significantly correlated with the independent variable (multi-network structure).

Table 4.
Correlation Analysis Table.

	Divergent Creativity	Multi-network Structure	Organizational Resilience	Organizational Legitimacy
Divergent Creativity	1			
Multi-network Structure	0.496**	1		
Organizational Resilience	0.483**	0.320**	1	
Organizational Legitimacy	0.202**	0.038	0.144**	1

Note: *p<0.05, **p<0.01, ***p≤0.001.

4.3. Reliability and Validity Analysis

As shown in Table 5, the Cronbach's α values for the two dimensions of multi-network structure were 0.925 and 0.927. For the three dimensions of organizational resilience, the values were 0.919, 0.945, and 0.870. For organizational legitimacy, the value was 0.800. For the four dimensions of divergent creativity, the values were 0.861, 0.935, 0.864, and 0.941. The corrected item-total correlations for all variables were greater than 0.4, and the Cronbach's α if item deleted was smaller than the overall alpha for each variable, indicating good reliability and internal consistency.

Table 5.
Reliability Analysis of Variables.

Scale	Dimension	Item Code	Scale Mean if Item Deleted	Scale Variance if Item Deleted	Corrected Item-Total Correlation	Cronbach's Alpha if Item Deleted	Cronbach'sα
Multi-network Structure	Management Network	GL1	28.337	54.306	0.721	0.918	0.925
		GL2	28.316	52.193	0.732	0.917	
		GL3	28.339	51.046	0.758	0.915	
		GL4	28.317	50.976	0.800	0.910	
		GL5	28.274	51.218	0.779	0.912	
		GL6	28.287	52.428	0.782	0.912	
		GL7	28.375	54.012	0.791	0.912	
	Institutional Network	ZD1	37.876	107.532	0.715	0.919	0.927
		ZD2	37.876	107.054	0.728	0.919	
		ZD3	37.854	108.209	0.712	0.920	
		ZD4	37.897	107.852	0.702	0.920	
		ZD5	37.881	108.023	0.712	0.920	
		ZD6	37.824	108.950	0.700	0.920	
		ZD7	37.807	109.045	0.714	0.920	
		ZD8	37.830	107.525	0.735	0.918	
		ZD9	37.847	107.505	0.728	0.919	
		ZD10	37.823	107.456	0.722	0.919	
Divergent Creativity	Fluency	LC1	16.973	23.812	0.686	0.831	0.861
		LC2	17.035	24.031	0.685	0.831	
		LC3	16.998	24.610	0.661	0.837	
		LC4	17.040	23.703	0.687	0.830	
		LC5	17.043	24.154	0.676	0.833	
	Flexibility	LH1	14.488	16.406	0.848	0.915	0.935
		LH2	14.526	16.436	0.835	0.919	
		LH3	14.499	16.575	0.855	0.913	
		LH4	14.495	15.997	0.851	0.914	
		LH5	17.035	24.055	0.703	0.830	0.864
	Originality	DC1	17.050	24.789	0.672	0.838	
		DC2	17.004	24.897	0.656	0.842	
		DC3	17.031	23.710	0.708	0.829	
		DC4	17.094	23.601	0.680	0.837	
	Elaboration	JM1	14.509	17.403	0.857	0.924	0.941

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		JM2	14.539	16.707	0.852	0.926	
		JM3	14.539	17.183	0.867	0.921	
		JM4	14.544	16.962	0.864	0.922	

Table 5.
Reliability Analysis of Variables (Continue…).

Scale	Dimension	Item Code	Scale Mean if Item Deleted	Scale Variance if Item Deleted	Corrected Item-Total Correlation	Cronbach's Alpha if Item Deleted	Cronbach'sα
Organizational Resilience	Adaptive Capability	SY1	19.451	25.476	0.814	0.898	0.919
		SY2	19.483	24.388	0.794	0.901	
		SY3	19.367	23.820	0.769	0.908	
		SY4	19.411	24.733	0.783	0.903	
		SY5	19.415	25.679	0.819	0.897	
	Anticipatory Capability	YQ1	24.357	50.572	0.807	0.938	0.945
		YQ2	24.335	49.715	0.842	0.933	
		YQ3	24.340	49.676	0.851	0.932	
		YQ4	24.344	49.623	0.853	0.932	
		YQ5	24.348	49.823	0.835	0.934	
		YQ6	24.350	50.427	0.806	0.938	
	Situational Awareness	QJ1	19.741	22.348	0.678	0.846	0.870
		QJ2	19.720	22.048	0.680	0.845	
		QJ3	19.749	21.343	0.690	0.843	
		QJ4	19.761	21.280	0.700	0.841	
		QJ5	19.767	22.099	0.725	0.835	
Organizational Legitimacy	Organizational Legitimacy	ZZ1	14.374	12.716	0.605	0.754	0.800
		ZZ2	14.393	12.522	0.605	0.754	
		ZZ3	14.465	12.673	0.588	0.763	
		ZZ4	14.374	12.204	0.655	0.730	

As shown in Table 6, the Composite Reliability (CR) values ranged from 0.919 to 0.960, all above the 0.7 threshold. The Average Variance Extracted (AVE) values ranged from 0.559 to 0.741, all above the 0.5 threshold. Furthermore, the square roots of the AVEs for all constructs were greater than their corresponding inter-construct correlations, indicating strong convergent and discriminant validity.

Table 6a.
Distinguishing and Convergent Validity

	Divergent Creativity	Multi-network Structure	Organizational Resilience	Organizational Legitimacy
Divergent Creativity	0.747			
Multi-network Structure	0.491**	0.741		
Organizational Resilience	0.497**	0.320**	0.861	
Organizational Legitimacy	0.220**	0.054	0.153**	0.852

Note: *p<0.05,**p<0.01,***p≤0.001.

Table 6b.
Correlation Analysis.

	AVE	CR
Divergent Creativity	0.559	0.919
Multi-network Structure	0.548	0.93
Organizational Resilience	0.741	0.958
Organizational Legitimacy	0.727	0.96

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4.4. Measurement Model

A confirmatory Factor Analysis (CFA) was conducted. The model fit indices were: $\chi^2/df = 1.154$ (<5), CFI = 0.992 (>0.9), TLI = 0.991 (>0.9), RMSEA = 0.013 (<0.08), and SRMR = 0.021 (<0.08), all meeting the recommended standards for good model fit [73]. The factor loadings for multi-network structure ranged from 0.548 to 0.930, for divergent creativity from 0.559 to 0.919, for organizational resilience from 0.741 to 0.958, and for organizational legitimacy from 0.727 to 0.960. All loadings were above 0.5, indicating good convergent validity [74].

Table 7.
Overall Goodness-of-fit Indices.

	AVE	CR	χ^2/df	CFI	TLI	RMSEA	SRMR
Divergent Creativity	0.559	0.919	1.154	0.992	0.991	0.013	0.021
Multi-network Structure	0.548	0.93					
Organizational Resilience	0.741	0.958					
Organizational Legitimacy	0.727	0.96					

To further validate the relationships between the variables, this study conducted Structural Equation Modeling (SEM) analysis using Mplus 8.3. According to the criteria suggested by Hu and Bentler [73] ($\chi^2/df < 5$; TLI > 0.90; CFI > 0.90; RMSEA < 0.08; SRMR < 0.08), the data showed a good fit with the measurement model, as detailed in Table 8.

Table 8.
Summary of Confirmatory Factor Analysis for Overall Constructs.

Variable	Items	χ^2/df	CFI	TLI	RMSEA	SRMR
Divergent Creativity	18	1.165	0.993	0.992	0.013	0.022
Multi-network Structure	17					
Organizational Resilience	16					
Organizational Legitimacy	4					

4.5. Common Method Bias Analysis

Harman's single-factor test was used to examine common method bias [75]. The results showed that the first unrotated principal component before rotation explained 31.026% of the variance, which is less than the 40% threshold, suggesting that common method bias is not a serious issue in this study [74] as shown in Table 9.

Table 9.
Common Method Bias Test.

Component	Initial Eigenvalues			Extraction Sums of Squared Loadings		
	Total	% of Variance	Cumulative %	Total	% of Variance	Total
1	14.186	24.459	24.459	14.186	24.459	24.459
2	6.022	10.383	34.841	6.022	10.383	34.841
3	2.887	4.978	53.315	2.887	4.978	53.315
4	2.502	4.314	57.630	2.502	4.314	57.630
5	2.161	3.726	61.356	2.161	3.726	61.356
6	2.055	3.543	64.899	2.055	3.543	64.899

4.6. Non-response Bias Analysis

Following Armstrong and Overton [76] a non-response bias test was conducted by comparing early and late respondents. Chi-square analysis and independent samples t-tests were performed on the demographic variables (industry type, number of employees, capital, and years of establishment). The results showed that the chi-square (χ^2) values for the demographic information between the two groups ranged from 0.069 to 2.133 (all p-values > 0.05), and all independent samples t-tests for equality of means were not significant (all p-values > 0.05, with confidence intervals including 0). This suggests

that there are no significant differences between the early and late respondent datasets. The test results indicate that non-response bias is not a serious concern in this study.

Table 10.
Non-response Bias Table.

No.	Basic Information	Early Respondents N	Late Respondents N	Chi-Square Test		Independent Samples T-Test	
				χ^2	p	t	p
1	Industry	474	452	1.541	0.214	-1.241	0.215
2	Number of Employees	474	452	1.386	0.847	0.350	0.726
3	Capital Amount	474	452	0.069	0.966	-0.075	0.941
4	Years of Establishment	474	452	2.133	0.344	1.140	0.255

5. Structural Equation Modeling

5.1. Direct Effect Analysis

First, the direct effect of the independent variable (multi-network structure) on the dependent variable (divergent creativity) was examined. The model fit indices were strong: $\chi^2/df = 1.858$ (<5), CFI = 0.991, TLI = 0.988 (>0.9), RMSEA = 0.030 (<0.08), and SRMR = 0.022 (<0.08), all meeting the recommended standards [73]. The analysis revealed that the path coefficient from multi-network structure to divergent creativity was significant ($\beta = 0.413$, $p < 0.05$). This indicates that multi-network structure has a significant positive effect on divergent creativity, thus supporting H1.

Next, a model examining the dimensions of the multi-network structure yielded good fit indices: $\chi^2/df = 2.209$ (<5), CFI = 0.983, TLI = 0.981 (>0.9), RMSEA = 0.033 (<0.08), and SRMR = 0.023 (<0.08) [73]. The path coefficient from the management network to divergent creativity was 0.357 ($p<0.05$), and the path coefficient from the institutional network to divergent creativity was 0.112 ($p<0.05$). Both were significant, indicating that the management network and the institutional network each have a significant positive effect on divergent creativity. Therefore, H1a and H1b are supported.

5.2. Mediation Effect Analysis

The fit indices for the mediation model with organizational resilience as the mediator were: $\chi^2/df = 2.013$ (<5); CFI = 0.985 and TLI = 0.981 (both >0.9); RMSEA = 0.025 (<0.08); and SRMR = 0.022 (<0.08), indicating an ideal fit [73].

Path analysis showed that the effect of multi-network structure on organizational resilience was significant ($\beta = 0.299$, $p < 0.05$), supporting H2. The effect of organizational resilience on divergent creativity was also significant ($\beta = 0.357$, $p < 0.05$), supporting H3.

To test for mediation, we used bootstrapping analysis. As shown in Table 11, the bootstrap 95% confidence interval for the total effect of "Multi-network Structure → Divergent Creativity" was [0.433, 0.600], which does not include 0, indicating a significant total effect. The confidence interval for the direct effect was [0.326, 0.499], which also does not include 0, indicating a significant direct effect. The confidence interval for the indirect mediating path "Multi-network Structure → Organizational Resilience → Divergent Creativity" was [0.067, 0.159], which does not include 0, confirming the existence of a mediating effect. Since both the indirect effect and the direct effect are significant, this indicates a partial mediation. Therefore, H4 is supported.

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Table 11.
Summary of the Effects Analysis.

Hypothesized Path	Standardized Path Coefficient	SE	t	p	LLCI	ULCL
Multi-network Structure → Divergent Creativity	0.413	0.045	9.230	0.000	0.326	0.499
Organizational Resilience → Divergent Creativity	0.357	0.058	6.146	0.000	0.247	0.473
Multi-network Structure → Organizational Resilience	0.299	0.046	6.457	0.000	0.210	0.390
Multi-network Structure → Divergent Creativity						
Total Effect	0.520	0.042	12.359	0.000	0.433	0.600
Indirect Effect	0.107	0.023	4.662	0.000	0.067	0.159
Direct Effect	0.413	0.045	9.230	0.000	0.326	0.499

5.3. Moderation Effect Analysis

This study examined organizational legitimacy as the moderating variable. First, its moderating role in the relationship between multi-network structure and divergent creativity was tested. As shown in Table 12, the interaction term (Multi-network Structure × Organizational Legitimacy) had a significant effect on divergent creativity ($\beta = 0.629$, $t = 11.43$, $p < 0.05$). The analysis indicates that the positive relationship between multi-network structure and divergent creativity is stronger when organizational legitimacy is high compared to when it is low. This indicates that organizational legitimacy positively moderates the relationship between multi-network structure and divergent creativity. Therefore, H6 is supported.

Table 12.
Summary of Moderation Effect Path Analysis Results

	Standardized Coefficient	SE	t	p
Organizational Legitimacy	0.066	0.051	1.289	0.198
Multi-network Structure	0.713	0.089	11.434	0.000
Multi-network Structure × Organizational Legitimacy	0.629	0.049	12.808	0.000

Next, the moderating effect of organizational legitimacy on the relationship between organizational resilience and divergent creativity was examined. As reported in Table 13, the interaction term (Organizational Resilience × Organizational Legitimacy) had a significant impact on divergent creativity ($\beta = 0.549$, $t = 12.725$, $p < 0.05$). The results show that the positive slope of the relationship between organizational resilience and divergent creativity is steeper for firms with high organizational legitimacy than for those with low organizational legitimacy. This result indicates that organizational legitimacy positively moderates the relationship between organizational resilience and divergent creativity. Therefore, H5 is supported.

Table 13.
Summary of Moderation Effect Path Analysis Result

	Standardized Coefficient	SE	t	p
Organizational Resilience	0.219	0.098	2.246	0.025
Organizational Legitimacy	0.066	0.051	1.289	0.198
Organizational Resilience × Organizational Legitimacy	0.549	0.043	12.725	0.000

6. Conclusions and Discussion

6.1. Results

This study yields the following three main conclusions:

First, a multi-network structure enhances the divergent creativity of firms within a cluster. Through the synergistic effects of management and institutional networks, a multi-network structure builds an ecosystem conducive to innovation. The management network promotes the dynamic evolution of the innovation ecosystem through inter-firm cooperation and competition [76]. The

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institutional network provides institutional guarantees for the innovation ecosystem through policy guidance and norm-setting [77].

Second, organizational resilience mediates the relationship between multi-network structure and divergent creativity. Organizational resilience emphasizes a firm's learning and adaptive capabilities. Within a multi-network structure, firms acquire diverse knowledge and experience through interactions with different nodes. Organizational resilience ensures that this knowledge is internalized and applied to innovation practices, thereby stimulating divergent creativity [10-12].

Third, organizational legitimacy serves as a positive moderator. It enhances a firm's trustworthiness within its cooperative network, enabling resilience capabilities (such as rapid market adaptation) to be more efficiently transformed into creativity through knowledge sharing and collaboration [57]. Organizational legitimacy helps a firm become a "hub node" in the multi-network, driving cross-network synergy (e.g., combining technical standards from policy networks with demand feedback from market networks) to achieve a systematic reorganization of resources and knowledge [55-62].

6.2. Implications

Theoretically, this study expands the boundaries of social network theory by proposing a differentiated mechanism for multi-network structures (management and institutional networks) [78] filling a gap in the existing literature regarding the insufficient segmentation of network types. Furthermore, it reveals the mediating role of organizational resilience, identifying it as a key pathway through which multi-network structure promotes divergent creativity [49]. It also innovatively introduces organizational legitimacy as a moderating variable [79] establishing it as a boundary condition and revealing how it strengthens the positive effects within the causal chain.

From a practical perspective, our findings suggest that firms should enhance their resilience through dual network embeddedness (in both management and institutional networks). For instance, they can leverage industry associations (institutional network) to obtain policy support while accelerating knowledge flow through supply chain cooperation (management network). This research also informs government policy design for industrial clusters, such as empowering firms through legitimacy-conferring actions (e.g., standard-setting) to strengthen collaborative innovation within the cluster [80].

6.3. Proposals

This study has several limitations that offer avenues for future research. First, the sample selection has limitations, as the empirical analysis is confined to industrial clusters in specific industries or regions, which may limit the representativeness and generalizability of the findings. Future research could expand the sample scope to include clusters from different industries, regions, and cultural backgrounds to enhance the generalizability of the conclusions.

Second, there are limitations in variable measurement. The variables involved in the study may be subject to measurement error, especially for more subjective variables like organizational legitimacy. Future research could employ more scientific and precise measurement methods to reduce errors in measuring subjective variables. Third, the research design is limited. This study uses cross-sectional data, which makes it difficult to capture the dynamic relationships and long-term impacts among the variables. Future studies could adopt a longitudinal research design to track the dynamic evolution of the relationships between multi-network structure, organizational resilience, and innovation.

Based on these findings, a further research agenda can be proposed. Future inquiry should deepen the study of multi-network structures; following [81] further exploration of the differential impacts of various network types (e.g., management, institutional, technological networks) on firm innovation and the interactions between these network structures is needed. The research perspective on organizational resilience should also be expanded; following [49] in-depth research into the formation mechanisms of organizational resilience and its role in the innovation process is warranted, particularly on how to enhance resilience through organizational design and resource allocation. Finally, research integrating

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policy and practice should be pursued, strengthening the link between theoretical research and policy practice to explore how policy interventions can optimize the network structure and innovation ecosystem of industrial clusters [82].

6.4. Research limitations and Future Prospects

First, the sample selection has limitations. The empirical analysis is confined to industrial clusters in specific industries or regions, which may limit the representativeness and generalizability of the sample. Future research could expand the sample scope to include clusters from different industries, regions, and cultural backgrounds to enhance the generalizability of the findings.

Second, there are limitations in variable measurement. The variables involved in the study (e.g., multi-network structure, organizational resilience, divergent creativity) may be subject to measurement error, especially for more subjective variables like organizational legitimacy. Future research could employ more scientific and precise measurement methods to reduce errors in measuring subjective variables.

Third, the research design is limited. This study uses cross-sectional data, which makes it difficult to capture the dynamic relationships and long-term impacts among the variables. Future studies could adopt a longitudinal research design to track the dynamic evolutionary processes of the relationships between multi-network structure, organizational resilience, and innovation.

Transparency:

The authors confirm that the manuscript is an honest, accurate, and transparent account of the study; that no vital features of the study have been omitted; and that any discrepancies from the study as planned have been explained. This study followed all ethical practices during writing.

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