systems

MDPI

Article

The Influencing Mechanism of Robustness of Emergency Medical Logistics: Mediating Role of Knowledge Integration

Jianhua Zhang, Ziao Cao *, Xiaoqian Zhou, Jinyan Liu and Hongyu Jia

School of Management, Zhengzhou University, Zhengzhou 450001, China; tjzhangjianhua@163.com (J.Z.); xiaoqianzhou21@163.com (X.Z.); liujinyan1993@126.com (J.L.); jiahongyu@gs.zzu.edu.cn (H.J.)
* Correspondence: ziaocao1@163.com

Abstract: Drawing on the social capital theory, the research examines the impact of network size, network centrality, trust, and regulation on the knowledge integration and robustness of emergency medical logistics. Additionally, the research seeks to provide deeper insight into the link between the variables by studying how knowledge integration mediates the relationship between independent variables and the robustness of emergency medical logistics. The study utilized structural equation modeling to assess the underlying assumptions of the research model. A total of 465 valid questionnaires were collected from government departments, hospitals, social teams, and enterprises. The data processing and analysis were conducted using SPSS 23.0 and AMOS 24.0 software. The study's outcome indicated that network size and network centrality have indirect effects on the robustness of emergency medical logistics through the intermediate variable of knowledge integration, but neither has a direct effect. Moreover, knowledge integration has a significant positive impact on the robustness of emergency medical logistics. Both trust and regulation have positive effects on the robustness of emergency medical logistics, and they also have positive effects on the robustness of emergency medical logistics through knowledge integration. This study is the inaugural exploration of the correlation between knowledge integration and the robustness of emergency medical logistics. It adds to the literature by providing evidence that knowledge integration is an essential emergency organization's aide in promoting the robustness of emergency medical logistics. The findings of this study establish a strong theoretical foundation and practical significance for ensuring and improving the level of effectiveness in emergency medical logistics management.

Keywords: robustness; emergency medical logistics; knowledge integration; social capital

check for updates

Citation: Zhang, J.; Cao, Z.; Zhou, X.; Liu, J.; Jia, H. The Influencing Mechanism of Robustness of Emergency Medical Logistics: Mediating Role of Knowledge Integration. *Systems* **2024**, *12*, 424. https://doi.org/10.3390/systems12100424

Academic Editor: Wen-Chyuan Chiang

Received: 13 September 2024
Revised: 6 October 2024
Accepted: 10 October 2024
Published: 11 October 2024

Copyright: © 2024 by the authors. Licensee MDPI, Basel, Switzerland. This article is an open access article distributed under the terms and conditions of the Creative Commons Attribution (CC BY) license (https://creativecommons.org/licenses/by/4.0/).

1. Introduction

In recent times, both regional and international natural disasters, along with public health emergencies, have become increasingly frequent occurrences. These events have had profound consequences for nations and individuals, resulting in significant losses. For instance, on 6 February 2023, Turkey experienced a devastating 7.8-magnitude earthquake, which led to losses exceeding USD 104 billion and claimed the lives of 50,000 people across the country [1]. In the aftermath of the earthquake, the affected area faced prolonged delays in the replacement of essential resources such as food and medicine, leaving the injured individuals to suffer. Consequently, the health and safety of those residing in the disaster-stricken region are now at serious risk due to a shortage of medical care.

Furthermore, the emergence of the COVID-19 pandemic in 2020 has exacerbated the issue of shortages. The insufficiency of emergency supplies has given rise to a multitude of problems [2]. The scarcity of urgently needed medical resources and anti-epidemic materials, including N95 masks, protective clothing, ventilators, and disinfectants, poses an elevated risk of infection for both residents and medical personnel. Moreover, it can lead to delays in patient treatment, thereby contributing to public anxiety [3].

The ability to quickly overcome the "failure" of organizational functions and restore the normal operation of logistics is crucial for emergency organizations [2]. The exploration and advancement of emergency medical logistics require comprehensive investigation and innovation in this specific domain. This not only ensures an adequate supply of emergency provisions for the affected region but also improves the preparedness for future significant emergencies [4]. Efforts are undertaken to reduce injuries and losses. The magnitude of losses incurred as a result of emergencies is substantial, underscoring the practical need to establish a reliable emergency medical logistics system and enhance emergency medical logistics capabilities [5].

Knowledge plays a crucial role in the field of emergency management as it provides valuable guidance and practical solutions to address the numerous challenges encountered during the disaster management process [6]. With the ever-increasing importance of knowledge and the vast amount of information available, it has become impractical for any single company to possess all the necessary resources [7]. As a result, seeking assistance and cooperation from other companies has become imperative in order to bring about a paradigm shift within the existing framework.

Hence, the utilization of networks has emerged as a crucial means for organizations to acquire resources. Based on the theory of social capital, this paper divides the dimensions of social networks, including the number and location of social network members and their connections with the other members of the social network, as well as the relationships among the social network members, including the closeness of the relationship and the direct or indirect relationship [8]. Finally, network size (NS), network centrality (NC), trust (T), and regulation (R) are selected as the independent variables. The structure and relationships of a network play a significant role in influencing an organization's ability to acquire resources and enhance its capabilities. The network organization of this study is in the emergency network, which has an organization of network members such as traffic, medical care, and telecommunications.

The key to an organization's competitive advantage lies in knowledge integration (KI) rather than singular knowledge [9]. In order to extend, integrate, and apply acquired knowledge to existing technologies or products, organizations need to develop their knowledge integration capabilities [10]. Nevertheless, the acquisition of fragmented and unorganized information resources from external sources has a limited impact on the organization itself. The enhancement of the overall capacities needs to be achieved through integrating knowledge and establishing a self-contained knowledge system [11].

In terms of the literature review, it becomes strikingly apparent that there has been a shortage of studies on the relationship between the robustness of emergency medical logistics (REML) and other variables. The theoretical research concerning the connection between the REML, social capital, and knowledge integration is still in its nascent stages, and empirical investigations on this particular topic are even more scarce. Table 1 is added to clearly illustrate the abbreviations of all variables and their meanings.

Table 1. The variables' abbreviations and meanings.

Variable	Acronym	Meaning
Network Size	NS	The number of member organizations within an emergency network
Network Centrality	NC	The degree of centrality and importance of an organization's network position within its network of key relationships
Trust	T	An organization's level of trust in its partners regarding transparency, honesty, knowledge sharing, and facilitating learning performance
Regulation	R	A recognized code of conduct among network members
Knowledge Integration	KI	An organization's ability to recognize the value of new external knowledge, digest and integrate it, and apply it to their business
Robustness of Emergency Medical Logistics	REML	The capability of self-organization and self-recovery when the emergency medical logistics network encounters sudden random event attacks

This research makes significant contributions in several ways. Firstly, it fills a gap in the existing literature by exploring the relationship between the REML and other important factors. By doing so, it provides a more comprehensive understanding of the factors that influence the effectiveness of emergency medical logistics. Secondly, the establishment of the "SC–KI-REML" framework offers a novel approach for analyzing the REML and can serve as a valuable tool for future research and practical applications. Thirdly, the empirical testing of the hypotheses using a structural equation model adds robustness to the findings and provides a scientific basis for decision-making in the field of emergency medical logistics. Consequently, this study addresses the following three research questions.

RQ1: How does social capital (network size, network centrality, trust, and regulation) influence the REML?

RQ2: How does social capital influence knowledge integration?

RQ3: How does social capital influence the REML through knowledge integration?

The remaining sections of the study are organized as follows: Section 2 provides a literature review, Section 3 explains the research technique employed to examine the proposed model, Section 4 presents the empirical findings, and Section 5 discusses the implications, originality, limitations, and future work.

2. Theoretical Underpinning and Hypotheses Development

2.1. Social Capital Theory

Social capital comprises social structural resources, such as information channels and social regulations [12]. It involves recognizing one's own interests, responsibilities, and expectations. Scholars have increasingly recognized that social capital not only influences human capital and intellectual capital but also affects knowledge creation, technological innovation, and business performance within organizations and regions [13]. Furthermore, it contributes to the economic prosperity of countries and regions as social capital theory continues to evolve. Additionally, social stability and growth are also influenced by social capital [14].

Social capital is a concept that plays a significant role in management research. It refers to the collective social ties formed, maintained, and exchanged by individuals or groups. Social capital is the aggregate of these social ties, emphasizing the role of resources in this process [15].

Swanson (2020) views social capital as a social structural resource [16]. They highlight how individuals realize their self-interests, obligations, and expectations by utilizing these structural resources. This perspective recognizes the importance of social capital in facilitating cooperation and achieving goals within organizations.

Nahapiet (2013) conceptualizes social capital in three categories: structural, relational, and cognitive [7]. The structural dimensions encompass network nodes, network structures, and usable organizations. The relational dimensions include trust, regulations, identity, and obligations. This comprehensive framework provides a holistic understanding of social capital and its various components. Finally, network size, network centrality, trust, and regulation are selected as the independent variables in this paper.

In management research, the measurement of social capital has been widely adopted. Sukoco, Hardi, and Qomariyah (2018) explore the relationship between social capital's structural embedding, relational embedding, and management performance [17]. They argue that social capital's instrumental value lies in managers gaining information advantages through social networks, which in turn leads to competitive advantages. Mura (2013) further supports the conceptualization of social capital at the structural level [18]. They highlight the network scope and network sophistication characteristics of social networks, which align with Nahapiet's findings. By fostering cooperative behavior and enhancing social efficiency, social capital becomes an essential organizational characteristic.

2.2. Robustness of Emergency Medical Logistics

Emergency medical logistics refers to the provision of emergency medical supplies during sudden natural disasters, public health emergencies, and other unforeseen events. The primary objective is to maximize time efficiency and minimize the losses caused by these disasters. The key issues that must be addressed include achieving fast and on-time delivery, implementing a low-cost and on-time strategy for material supply, ensuring accurate delivery of logistics information, and promoting information feedback and sharing [19]. Additionally, the flexibility of the logistics system and the coordination of supply and demand are crucial for establishing a seamless supply chain connection during emergencies [20].

The emergency medical logistics system comprises various personnel from the military, businesses, and governments. Its operations involve specific components, such as the construction of emergency centers, procurement of emergency materials, management of emergency material warehouses, and transportation and distribution of materials [21]. As a result, the emergency medical logistics system is a vast and intricate system that requires the implementation of emergency technologies, personnel, and equipment.

A comprehensive emergency medical logistics system should be able to respond rapidly to different circumstances. This rapid response consists of two main components. The first component is the quick response to the disaster itself. The second component involves the swift establishment of emergency organizations, such as social welfare organizations and social volunteers, based on specific circumstances [22]. The challenge lies in organizing the personnel within a unified emergency system and ensuring that all the linkages are error-free in order to maximize the benefits.

Since the 1970s, the term "robustness", originally used in statistics, has gained significant popularity in the study of control theory. This property of complex systems has become a subject of great interest among academics, particularly in recent years [23]. In the face of uncertainty, the survival of a system now relies on its robustness. According to the currently accepted definition in the field of supply chain research, robustness refers to the ability of a system to maintain its functionality despite modifications to its internal structure or external environment [23].

Building upon the aforementioned explanation and understanding of robustness, combined with the unique characteristics of emergency medical logistics, the robustness of an emergency medical logistics network can be defined as follows: when the emergency medical logistics network encounters sudden random event attacks during emergency support activities, it demonstrates the abilities of self-organization and self-recovery.

2.3. Network Size

In this paper, the term "network size" refers to the number of member organizations within an emergency network that maintain stable connections. Generally, a larger network provides more opportunities and channels for accessing scarce resources, such as information, technology, and expertise. In a large network with numerous nodes, communication occurs not only directly between network partners but also indirectly through shared partners [24]. Considering these factors, organizations with larger scales or more network connections possess greater advantages in terms of resource channels. This means that they can acquire valuable information and knowledge earlier, leading to more opportunities for resource sharing, complementarity, and increased social capital.

Furthermore, a larger network scale offers organizations more opportunities to engage in knowledge exchange and knowledge-related activities with other network organizations, thus influencing their knowledge integration capabilities. Knowledge integration is an information processing system among organizational members [25]. In the context of partnerships, emergency medical logistics organizations must transmit relevant information to the member organizations and receive pertinent information from them [21]. Based on these observations, we hypothesize the following:

H1a: *Network size positively impacts knowledge integration.*

The network scope reflects the abundance of the resources within an organization's emergency network. According to Szász, Scherrer-Rathje, and Deflorin (2016), organizations can expand their network scale by establishing new network relationships, thus enabling them to obtain valuable resources and enhance their performance [26]. An organization's network size can improve its ability to acquire resources from the network. These resources, obtained through organizational innovation activities [24], can be transformed into performance.

A larger network enables the organization to acquire more resources from the external social network, thereby enhancing the team's resource acquisition capability and the robustness of emergency medical logistics. Based on this, the paper makes the following assumptions regarding the relationship between the scale of the emergency medical logistics team's social network and the robustness of emergency medical logistics:

H1b: *Network size positively impacts the robustness of emergency medical logistics.*

2.4. Network Centrality

In this paper, network centrality is defined as the degree of centrality and importance of an organization's network position within its network of key relationships. The centrality of a network position is an important aspect of the network structure that relates to what the organization can achieve and reveals its ability to create new value and reach new goals [27].

Access to new and heterogeneous knowledge is important for emergency organizations. Different network locations represent different opportunities for an organization to acquire new knowledge, revealing its ability to acquire external information technology knowledge and information [28]. The position of the organization in the network of key relationships in which it is located provides it with certain advantages of receiving special information and resources. Because of the location advantage, the more centrally located the organization is in the network interaction, the more it can potentially integrate and exchange resources with its key partners, and such resources will stimulate the organization's innovative activity and efficiency by providing the necessary external information and new ideas [27]. The centrality of the organization within the network determines its access to more heterogeneous resources, and therefore influences the ability to identify and respond quickly in unexpected situations.

Therefore, in the key relationship network, the more the organization occupies the center of the network, the higher the probability of its proximity to the knowledge resources and information of other organizations, and the easier it is to promote the knowledge integration capability of the emergency response and the robustness of the whole system.

H2a: *Network centrality positively impacts knowledge integration.*

H2b: *Network centrality correlates positively with the robustness of emergency medical logistics.*

2.5. Trust

Network trust refers to an organization's level of trust in its partners regarding transparency, honesty, knowledge sharing, and facilitating learning performance [29]. In practice, trust plays a crucial role in fostering cooperation among the members of an organization and reducing uncertainty and transaction costs. When enterprises establish relationship capital with external entities and contacts, it encourages them to uphold their commitments and embrace shared values. This, in turn, promotes the integration of knowledge and diversity, leading to the generation of innovative knowledge [17]. Trust of an enterprise helps to bridge the gap in interests, goals, and values among different enterprises, enabling the rapid sharing and transfer of knowledge. This facilitates smooth communication

and exchange between enterprises, ultimately enhancing their capacity for knowledge integration.

Trust plays a crucial role in facilitating knowledge transfer among emergency organizations. It helps to create an open and fair learning atmosphere, enabling the effective sharing of important knowledge, particularly tacit knowledge that is challenging to transfer. Trust also influences the willingness of participants to engage in knowledge-sharing activities, which, in turn, impacts an organization's ability to integrate knowledge [21]. Based on these points, we can make the following assumption:

H3a: *Trust positively impacts knowledge integration.*

In reality, trust plays a crucial role in fostering cooperation as individuals who are perceived as trustworthy are more likely to receive support from others [30]. Many researchers argue that trust is the cornerstone of successful partnerships. When there is mutual trust, both parties are able to find effective solutions to conflicts and inefficiencies as it promotes positive attitudes and behavior. Trust also fosters collaboration within an organization, facilitates communication between different nodes, and contributes to the overall cohesion and competitiveness of a network [29].

According to this perspective, trust is not only linked to the level of corporate social capital but also to the efficient functioning of network member organizations. Numerous studies have shown that trust enhances cooperation between network organizations, reduces uncertainty, and lowers transaction costs. In the field of emergency management, crises often arise unexpectedly, and the initial plans and directives may fail. Implementing new plans or temporary initiatives can negatively impact the efficiency of inter-organizational collaboration. In such situations, trust becomes crucial in facilitating interaction between public emergency organizations and network members as it encourages network members to take calculated risks [31]. Based on the above discussion, a hypothesis can be proposed as follows:

H3b: *Trust positively impacts the robustness of emergency medical logistics.*

2.6. Regulations

Regulations play a crucial role in network systems as they represent a recognized code of conduct among network members. They serve as a level of consensus in a social system, ensuring high efficiency and facilitating the achievement of the organizational objectives. By adhering to regulations, network members compensate for their lack of rationality and reduce the cost of errors. The internal normative guidance provided by regulations can evolve into a spontaneous network order [32]. This confined structure encourages the actors within a network to regulate themselves and improve the credibility of the network members, thereby increasing the social capital. As the network continues to grow and foster cooperative interactions, the mutual trust is further bolstered, and shared values and regulations are established [33].

In emergency situations, regulations enable emergency organizations to comprehend the purpose of cooperation and align their objectives. This alignment goes beyond a basic combination of efforts and enhances the communication efficacy of emergency organizations, reducing the likelihood of misunderstandings.

Moreover, when the organizations within a network share common regulations or similar behavior patterns, it facilitates communication and interaction among the network members. This, in turn, enhances their capacity to integrate knowledge and acquire valuable information from one another. Common values among organizations also contribute to the exchange of valuable information and resources [32]. The following assumptions are therefore accepted:

H4a: *Regulation positively impacts knowledge integration.*

Social capital includes the trust in values or regulations that encourages people to unite and cooperate in groups and organizations for common objectives [34]. When a regulation becomes the consensus of the network members, it will regulate and restrict the members' behavior and serve as a lubricant and assurance mechanism for their operation. Regulations can ensure the certainty of pertinent information and behaviors, reduce the operating costs of the entire network, and thus protect the long-term interests of both individual organizations and the network as a whole. When the trust among the network node organizations is minimal, it is necessary to establish and maintain a network of obligations. Regulation is conducive to forming a common value orientation and unified behavioral regulations among organizations, calming down in the face of crises, coordinating the relationship between the government and the market, the government and the public, and reducing the cost of public crisis management, thus improving the effectiveness of public emergency management [35]. The following assumptions are therefore accepted:

H4b: *Regulation positively impacts the robustness of emergency medical logistics.*

2.7. Knowledge Integration

Numerous researchers have analyzed the ability of organizations to integrate knowledge from various perspectives. According to Runhui and Lun (2023), knowledge integration capability refers to an organization's ability to recognize the value of new external knowledge, digest and integrate it, and apply it to their business [36]. Han (2018) defines the ability to integrate knowledge as the capacity of an enterprise to comprehensively implement its existing and acquired knowledge [35]. Sun et al. (2022) believe that knowledge integration capability encompasses systematization, cooperation, and socialization [9]. Runhui and Lun (2023) further classify knowledge integration ability into systematic ability, interactive coordination ability, and socialization ability [36]. Based on the research of these scholars, this paper examines knowledge integration ability from the perspectives of systematization, cooperation, and socialization abilities.

Ayoub, Abdallah, and Suifan (2017) argue that, in the knowledge-based economy era, businesses must strengthen cooperation with other organizations by constructing network organizations to maintain a competitive advantage [37]. In a complex and dynamic environment, it is not enough for an organization to possess talent and technology. Resources are widely dispersed and exist in different organizations, mastered by specialists in various fields. Therefore, organizations must have the ability to integrate their resources to respond rapidly and effectively to crises [38]. Emergency organizations must be able to observe and adapt to changes in their internal and external environments in a timely manner during a crisis and continuously expand their knowledge base through learning.

Consequently, the key to enhancing the robustness of medical logistics in emergency organizations lies in their ability to effectively incorporate internal and external organizational knowledge.

H5: *Knowledge integration positively impacts the robustness of emergency medical logistics.*

2.8. Mediation Effects of Knowledge Integration

Organizations acquire knowledge resources through social networks, and knowledge integration is crucial for transforming external knowledge into internal knowledge. Therefore, social networks have a significant impact on knowledge integration. According to Sukoco (2018), empirical research supports the hypothesis that team social networks have a positive and substantial association with knowledge integration [17]. Runhui and Lun (2023) argue that organizations must integrate the knowledge acquired from external sources into their own knowledge structure to fulfill their roles effectively [36]. Sun et al. (2022) conduct empirical research and propose that knowledge integration can enhance the innovation performance of entrepreneurial enterprises [9]. By sorting and categorizing knowledge, organizations can assimilate external knowledge resources and improve the

efficiency and effectiveness of innovation. To maintain a competitive advantage, organizations must continuously integrate external knowledge resources with their existing internal knowledge resources to achieve their objectives.

As the size of the network expands, the communication between the members, who are the main drivers of knowledge integration, increases. However, the impact of this communication on outcomes varies depending on the strength of the knowledge integration ability [35]. Network centrality is used to measure a member's capacity to connect with other members. Members with high centrality, enabled by strong knowledge integration abilities, can acquire the knowledge resources of other members, especially tacit knowledge, thereby enhancing the robustness of medical logistics [39]. Trust fosters openness and transparency among members, encouraging resource sharing. Effective knowledge integration allows organizations to make better use of these resources, contributing to enhanced robustness. Common norms or similar behavior patterns between organizations facilitate communication and knowledge exchange, and knowledge integration promotes the robustness of medical logistics [18].

Based on the analysis presented above, this study articulates the following hypotheses:

H1c: *The relationship between network size and the robustness of emergency medical logistics is mediated by knowledge integration.*

H2c: *The relationship between network centrality and the robustness of emergency medical logistics is mediated by knowledge integration.*

H3c: *The relationship between trust and the robustness of emergency medical logistics is mediated by knowledge integration.*

H4c: *The relationship between regulation and the robustness of emergency medical logistics is mediated by knowledge integration.*

Hence, hypotheses and illustrations framework (Figure 1) is put forward.

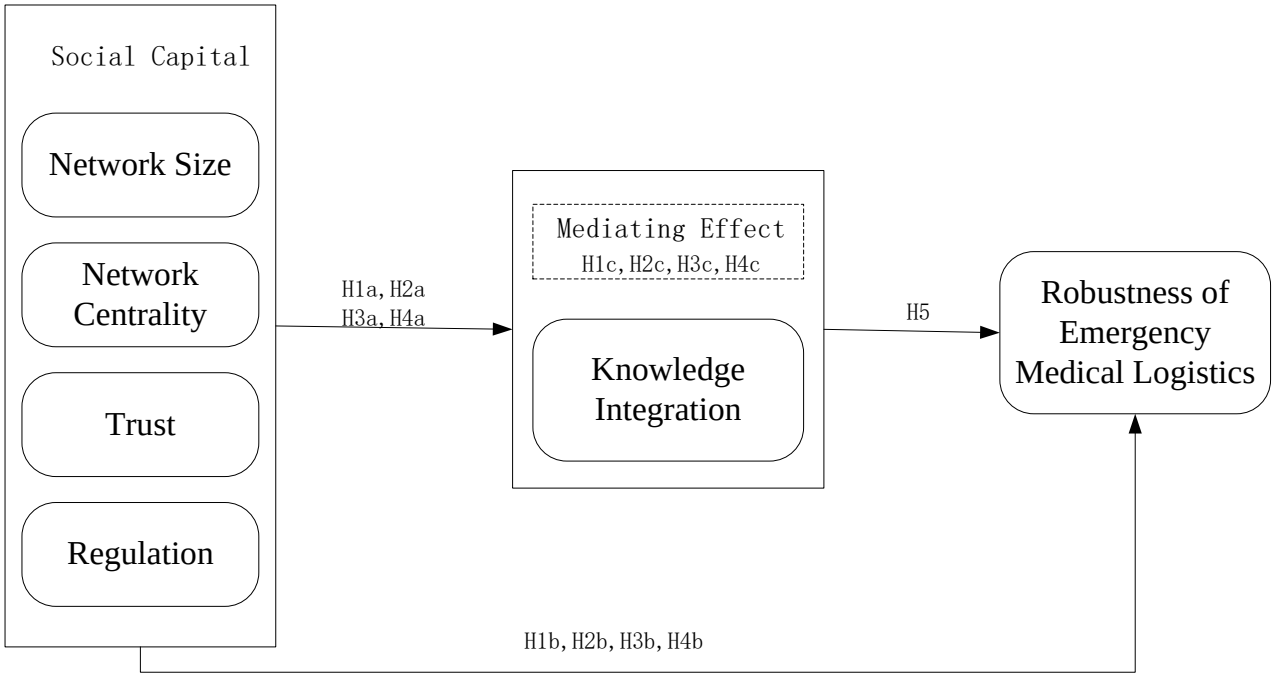

Figure 1. Study framework.

3. Research Technique

3.1. Target Organizations and Sample Design

In order to gain a better understanding of the surveyed groups, a descriptive analysis was conducted, as presented in Table 2. This study primarily focused on emergency-related organizations in Henan Province, China. Henan Province is a central province in China, which contains one of largest populations and complex landform. In recent years, there have been many natural and public health disasters in Henan Province, causing serious human and economic losses, so emergency organizations in Henan Province have relatively rich experiences, and it is also representative of all provinces in the country [40].

Table 2. Demographic characteristics of the sample.

Variable	Attribute	Frequency	Percent	Cumulative Percent
Gender	Male	274	58.9	58.9
	Female	191	41.1	100.0
Education background	Junior college and below	107	23.0	23.0
	Bachelor's degree	143	30.8	53.8
	Master's degree and above	215	46.2	100.0
Organization Type	Government departments	107	23.0	23.0
	Hospital	91	19.6	42.6
	Social groups	74	15.9	58.5
	Enterprise	193	41.5	100.0

Our team visited a total of 11 government departments, 8 hospitals, 4 social groups, and 13 medical logistics companies; a total of 603 questionnaires were distributed between November 2023 and April 2024. Out of these, feedback was received for 486 questionnaires, and, after careful scrutiny, 465 questionnaires were deemed valid.

The data in the table reveal that, in terms of gender distribution, there were 274 males, accounting for 58.9%, and 191 females, accounting for 41.1%. It is evident that the number of females is lower than that of males. Regarding education level, the majority of respondents held a master's degree or above, with 215 individuals accounting for 46.2%. This was followed by a bachelor's degree, with 143 individuals accounting for 30.8%. The proportion of respondents with a junior college degree or below was relatively lower at 23.0%. In terms of organizational type, enterprises ranked first, accounting for 41.5%, followed by government departments at 23.0%. Social organizations had the lowest representation, accounting for 15.9%. Overall, the sample distribution was diverse and representative.

For data processing and analysis, this study utilized SPSS 23.0 and AMOS 24.0 software. All items were scored on a five-point Likert scale, ranging from 1 = "strongly disagree" to 5 = "strongly agree".

3.2. Measurement Item

The questionnaire was divided into seven parts. The first part includes respondent demographic information. Parts two to five each contain three questions. Parts six and seven consist of five questions each. Table 3 presents information about the questionnaire and the sources used to achieve a higher study construct. The details of Questionnaire are presented in Appendix B.

Table 3. Measurement items.

Variable	Item	Source
Network Size	3	Putnam (1995) [41]
Network Centrality	3	Tsai and Ghoshal (1998) [28]

Table 3. *Cont.*

Variable	Item	Source
Trust	3	Chiu, Hsu and Wang (2006) [42]
Regulation	3	Chiu, Hsu and Wang (2006) [42]
Knowledge Integration	5	Nevis, DiBella and Gould (1995) [43]
Robustness of Emergency Medical Logistics	5	Mallak(1998) [44] and Somers(2009) [45]

3.3. Common Method Bias

The single-factor method was employed to assess the risk of common method bias. This involved conducting an unrotated exploratory factor analysis on all the measurement items of the questionnaire. The purpose of this analysis was to determine whether the first factor explained more than 40% of the total variance [46]. The results of the single-factor test can be found in Appendix A. It was observed that no single factor accounted for a majority of the data variance, indicating that the risk of common method bias does not pose a significant threat.

3.4. Reliability and Validity Analysis

Reliability refers to the credibility of the sample data. After importing the survey data of this study into SPSS 23.0 and running the analysis, the reliability analysis results for each variable are obtained. These results are presented in Table 4. The Cronbach's α value is greater than 0.7, indicating that the measurement model has high reliability and stability [47]. Therefore, the questionnaire variables demonstrate good reliability and meet the research requirements.

Table 4. Exploratory factor analysis and reliability testing.

Variable	Item	Component						Extraction	Cronbach's Alpha
		1	2	3	4	5	6		
NS	NS1	0.203	0.214	0.812	0.115	0.158	0.181	0.817	0.896
	NS2	0.161	0.263	0.828	0.162	0.169	0.112	0.848	
	NS3	0.188	0.239	0.827	0.126	0.081	0.161	0.825	
NC	NC1	0.113	0.122	0.120	0.105	0.812	0.106	0.724	0.830
	NC2	0.170	0.198	0.134	0.126	0.823	0.053	0.781	
	NC3	0.116	0.239	0.094	0.149	0.799	0.053	0.744	
T	T1	0.169	0.163	0.116	0.812	0.130	0.095	0.754	0.864
	T2	0.246	0.227	0.123	0.808	0.168	0.106	0.819	
	T3	0.198	0.240	0.146	0.800	0.123	0.125	0.790	
R	R1	0.234	0.177	0.132	0.089	0.070	0.807	0.768	0.819
	R2	0.245	0.154	0.157	0.068	0.064	0.793	0.746	
	R3	0.103	0.227	0.118	0.149	0.089	0.775	0.707	
KI	KI1	0.230	0.715	0.208	0.196	0.141	0.166	0.693	0.885
	KI2	0.215	0.714	0.126	0.165	0.132	0.161	0.643	
	KI3	0.272	0.700	0.184	0.156	0.210	0.194	0.704	
	KI4	0.195	0.752	0.204	0.165	0.164	0.159	0.724	
	KI5	0.162	0.735	0.195	0.152	0.176	0.128	0.675	
REML	REML1	0.799	0.221	0.107	0.169	0.147	0.111	0.762	0.917
	REML2	0.795	0.257	0.134	0.132	0.128	0.081	0.757	
	REML3	0.775	0.183	0.147	0.147	0.110	0.208	0.734	
	REML4	0.800	0.176	0.149	0.129	0.085	0.196	0.756	
	REML5	0.807	0.154	0.136	0.181	0.096	0.168	0.764	
Rotation Sums of Squared Loadings	Total	3.814	3.345	2.441	2.349	2.319	2.267		
	% of Variance	17.335	15.206	11.095	10.675	10.539	10.306		
	Cumulative %	17.335	32.541	43.636	54.311	64.850	75.156		

Conversely, validity refers to the accuracy with which the research scale or concept of the research variable can be measured using appropriate instruments and methods. Content validity and construct validity are typically employed for measuring questionnaires.

The specific results of utilizing the maximum variance method are shown in Table 4. The total explained variance is 75.156%, and the common degree of variables is above 0.5. This indicates that the amount of missing information is relatively small, and the 6 factors that have been screened out are highly representative. Additionally, the maximum factor loading of each measurement item is greater than 0.5, indicating good construct validity for these variables. Overall, the validity test has been passed, demonstrating that the structural validity of these variables meets the requirements of statistical research.

3.5. Evaluation of Measurement Models

Model evaluation refers to the verification of each hypothetical path in the structural equation model, and the CR coefficient is used to determine whether the model hypotheses reach statistical significance. When the CR value is greater than 1.96, it corresponds to a significance level of $p < 0.05$. When the CR value is greater than 2.58, it corresponds to a significance level of $p < 0.01$. When the CR value is greater than 3.29, it corresponds to a significance level of $p < 0.001$.

Table 5 shows the path coefficients of the measurement model. From the data in the table, it is evident that the loadings of the standardized factors of the potential variables for each measurement indicator are between 0.724 and 0.887, which meets the criterion of factor loadings larger than 0.5. There is no negative measurement error for each study variable, and the standard error is relatively small. The critical ratios were all greater than 3.29, which passed the 0.001 significance level test (p-value < 0.001, indicated by the "***" symbol), indicating that the explanatory power of the measurement terms of the variables to the measurement model was strong and the basic fitness of the model was good. The component reliabilities of latent variables NS, NC, T, R, KI, and REML were 0.896, 0.831, 0.865, 0.821, 0.885, and 0.917, respectively, which were all greater than 0.7. The mean variance extractions were 0.742, 0.622, 0.683, 0.606, 0.607, and 0.688, respectively, which were all greater than 0.5. All of them meet the criteria of convergent validity, and the fitness is in the acceptable range, so the model passes the validation factor analysis test, and the variable dimensions are set scientifically and reasonably.

Table 5. Confirmatory factor analysis of the variables.

			Unstandardized Estimate	S.E.	C.R.	*p*	Standardized Estimate	SMC	1-SMC	CR	AVE
NS1	<---	NS	1				0.849	0.720	0.280		
NS2	<---	NS	1.045	0.045	23.265	***	0.887	0.787	0.213	0.896	0.742
NS3	<---	NS	0.967	0.044	22.014	***	0.847	0.718	0.282		
NC1	<---	NC	1				0.725	0.526	0.474		
NC2	<---	NC	1.236	0.079	15.739	***	0.843	0.711	0.289	0.831	0.622
NC3	<---	NC	1.143	0.075	15.309	***	0.794	0.631	0.369		
T1	<---	T	1				0.751	0.564	0.436		
T2	<---	T	1.244	0.068	18.388	***	0.885	0.784	0.216	0.865	0.683
T3	<---	T	1.141	0.064	17.743	***	0.837	0.700	0.300		
R1	<---	R	1				0.819	0.671	0.329		
R2	<---	R	0.994	0.061	16.412	***	0.789	0.623	0.377	0.821	0.606
R3	<---	R	0.939	0.062	15.266	***	0.724	0.525	0.475		
KI1	<---	KI	1				0.800	0.640	0.360		
KI2	<---	KI	0.907	0.054	16.667	***	0.727	0.528	0.472		
KI3	<---	KI	1.062	0.055	19.227	***	0.814	0.662	0.338	0.885	0.607
KI4	<---	KI	1.031	0.054	18.945	***	0.804	0.647	0.353		
KI5	<---	KI	0.922	0.053	17.275	***	0.748	0.559	0.441		

Table 5. *Cont.*

		Unstandardized Estimate	S.E.	C.R.	*p*	Standardized Estimate	SMC	1-SMC	CR	AVE
REML1 <---	REML	1				0.837	0.701	0.299		
REML2 <---	REML	0.981	0.045	21.558	***	0.830	0.689	0.311		
REML3 <---	REML	0.971	0.046	21.008	***	0.816	0.666	0.334	0.917	0.688
REML4 <---	REML	0.979	0.045	21.549	***	0.830	0.688	0.312		
REML5 <---	REML	1.017	0.047	21.782	***	0.835	0.698	0.302		

If *p*-value < 0.001, indicated by the "***".

3.6. Correlation Analysis and Discriminant Validity

Correlation analysis is a statistical method used to determine the connection between two or more variables. In this study, an AVE (Average Variance Extracted) method was employed to evaluate the discriminant validity. To establish discriminant validity, the square root of each variable's AVE should be greater than the correlation coefficient between the variables. Table 6 provides an overview of the variable differences discussed in this paper.

Table 6. Discriminant validity.

	NS	NC	T	R	KI	REML
NS	0.861					
NC	0.386 **	0.789				
T	0.418 **	0.399 **	0.826			
R	0.430 **	0.277 **	0.362 **	0.778		
KI	0.574 **	0.491 **	0.539 **	0.504 **	0.779	
REML	0.461 **	0.375 **	0.491 **	0.477 **	0.568 **	0.829
Mean	3.731	3.655	3.687	3.665	3.738	3.642
Std. Deviation	0.746	0.672	0.707	0.864	0.745	0.964

** Correlation is significant at the 0.01 level (2-tailed).

In Table 6, we can observe the correlation coefficients between NS, NC, T, R, and KI. The correlation coefficients for NS, NC, T, and R with KI are 0.574, 0.491, 0.539, and 0.504, respectively. The corresponding *p*-values indicate a significant level of 0.05, suggesting that NS, NC, T, and R have significant positive correlations with KI.

Similarly, the correlation coefficients for NS, NC, T, R, and KI with REML are 0.461, 0.375, 0.491, 0.477, and 0.568, respectively. The *p*-values also reach a significant level of 0.05, indicating a significant positive correlation between NS, NC, T, R, KI, and REML.

The absolute value of the correlation coefficient ranges from 0.277 to 0.574, while the square root of AVE ranges from 0.778 to 0.861. It is evident that the absolute values of the correlation coefficients are all smaller than the square root of the variable AVE. This demonstrates that the discriminant validity among the research variables meets the requirements of the study.

4. Results

4.1. Structural Equation Path Analysis

Structural equation models (SEMs) are a combination of confirmatory factor analysis and econometric modeling techniques used to analyze hypothetical relationships between variables. The main advantage of an SEM is its ability to evaluate the fit value of the model [48]. In this case, an SEM was employed to test the relationship between the potential variables in the model, and the fit value of the model was evaluated using AMOS 23.0 analysis software.

By using an SEM, researchers can assess the goodness-of-fit of the model and determine whether the hypothesized relationships between the variables align with the observed

data. This approach enables a comprehensive evaluation of the theoretical framework and provides insights into the complex interplay between the variables.

AMOS 23.0 analysis software is commonly used in SEMs to estimate the model parameters, assess the model fit, and generate graphical representations of the relationships between the variables. It provides researchers with a powerful tool to validate their theoretical models and gain a deeper understanding of the underlying mechanisms.

4.1.1. Construction of the Structural Model

Combined with the previous related research and related theories, the structural equation model studied in this paper was finally determined, as shown in Figure 2.

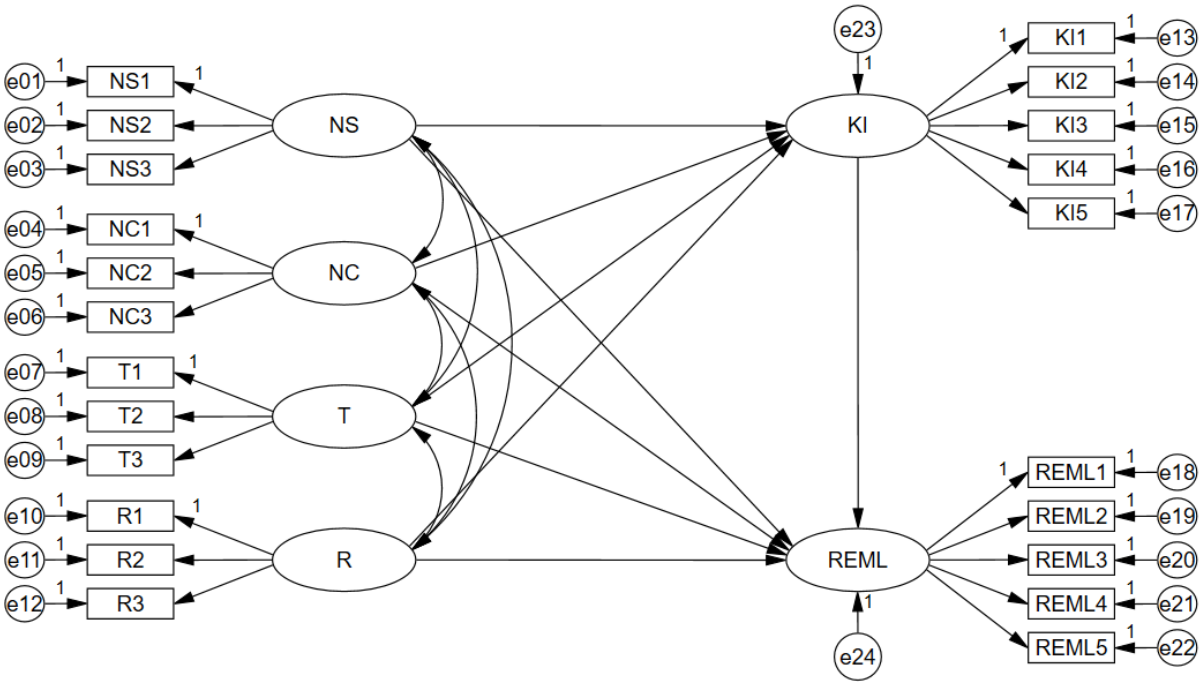

Figure 2. The structure equitation model.

4.1.2. Structural Model Fitting

The fitting indicators for Figure 2 were determined using the AMOS software. The specific fitting indicators can be found in Table 7. The CMIN/DF value is 1.035, which is less than 3 and meets the judgment standard. Additionally, both GFI and AGFI meet the acceptable standard of 0.9. The values for IFI, TLI, and CFI all reach 0.9. Furthermore, the RMR and RMSEA values are 0.019 and 0.009, respectively, both of which are less than 0.08. Both PGFI and PNFI are greater than 0.5. Therefore, the main fitting indicators selected in this paper align with the standards of general SEM research, indicating that the structural model has a good degree of fitness.

Table 7. Model fit indices of structural models.

Model Fit Index	Acceptable Value	Value
CMIN		200.731
DF		194
CMIN/DF	<3	1.035
GFI	>0.9	0.962
AGFI	>0.9	0.951
RMR	<0.08	0.019

Table 7. *Cont.*

Model Fit Index	Acceptable Value	Value
RMSEA	<0.08	0.009
IFI	>0.9	0.999
TLI	>0.9	0.999
CFI	>0.9	0.999
PGFI	>0.5	0.738
PNFI	>0.5	0.813

4.1.3. Structural Model Analysis Results

It is evident from Table 8 that the standardized coefficients of NS, NC, T, and R on KI are 0.291, 0.238, 0.257, and 0.256, respectively. Additionally, the *p*-value is less than 0.05, indicating that NS, NC, T, and R have a significant positive impact on KI. Therefore, hypotheses H1a, H2a, H3a, and H4a are established. On the other hand, the standardized coefficients of NS and NC on the REML are 0.083 and 0.058, respectively. The *p*-value is greater than 0.05, suggesting that NS and NC do not have a considerable effect on the REML. Consequently, hypotheses H1b and H2b are not supported. Furthermore, the standardized coefficients of T, R, and KI on the REML are 0.220, 0.245, and 0.266, respectively. The *p*-value is less than 0.05, indicating that T, R, and KI have a significant positive impact on the REML. Therefore, hypotheses H3b, H4b, and H5 are established. Based on the path coefficients displayed in Table 8, the standardized coefficients of the structure equitation model is made in Figure 3.

Table 8. Path coefficients for structural model.

Path	Unstandardized Estimate	Standardized Estimate	S.E.	C.R.	*p*
NS→KI	0.294	0.291	0.050	5.865	***
NC→KI	0.311	0.238	0.063	4.959	***
T→KI	0.314	0.257	0.060	5.260	***
R→KI	0.228	0.256	0.043	5.297	***
NS→REML	0.110	0.083	0.074	1.476	0.140
NC→REML	0.099	0.058	0.091	1.089	0.276
T→REML	0.352	0.220	0.089	3.972	***
R→REML	0.286	0.245	0.065	4.400	***
KI→REML	0.348	0.266	0.097	3.586	***

If *p*-value < 0.001, indicated by the "***".

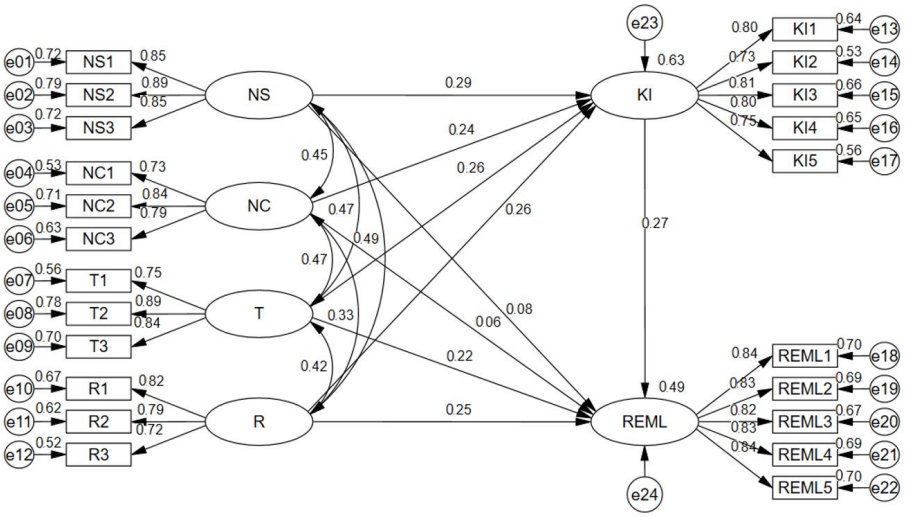

Figure 3. Standardized coefficients of the structure equitation model.

4.2. Mediation Effect

The significance of the mediation effect was tested using the Bootstrap method [49]. First, the repeated random sampling method was used to extract Bootstrap samples from the original data (N = 465). Then, fit the model based on these samples, generate and save the estimated value of the mediating effect, form an approximate sampling distribution, calculate the average path value of the mediating effect, and sort these effect values by numerical size. The 95% confidence intervals for the mediation effect were estimated using the 2.5th percentile and the 97.5th percentile. If the 95% confidence intervals for these path coefficients do not include 0, this indicates that the mediation effect is significant. The confidence intervals (or significance) of the standardized direct effects are then considered to see if they include 0. If they do (not significant), it is completely mediated; otherwise, it is partially mediated. A complete mediating effect means that the influence of the independent variable on the dependent variable is fully realized through the mediating variable. A partial mediating effect indicates that only a portion of the independent variable's impact on the dependent variable is exerted through the mediating variable, while the remainder is realized through a direct effect.

The results from Table 9 indicate that the 95% confidence interval for the indirect effect of NS on the REML is [0.015, 0.149], and, for NC on the REML, it is [0.011, 0.129]. Since neither interval contains 0, we can conclude that the mediation effect is significant.

Table 9. Bootstrap test of mediation effects.

Item	Effect	Estimate	SE	95% CI		*p*
				Lower	Upper	
KI between NS and REML	Standardized Total Effects	0.160	0.065	0.027	0.286	0.018
	Standardized Indirect Effects	0.077	0.034	0.015	0.149	0.006
	Standardized Direct Effects	0.083	0.067	−0.054	0.213	0.231
KI between NC and REML	Standardized Total Effects	0.121	0.052	0.013	0.218	0.029
	Standardized Indirect Effects	0.063	0.029	0.011	0.129	0.006
	Standardized Direct Effects	0.058	0.054	−0.052	0.159	0.286
KI between T and REML	Standardized Total Effects	0.288	0.063	0.156	0.405	0.001
	Standardized Indirect Effects	0.068	0.028	0.016	0.126	0.006
	Standardized Direct Effects	0.220	0.064	0.100	0.347	0.001
KI between R and REML	Standardized Total Effects	0.313	0.072	0.180	0.469	0.001
	Standardized Indirect Effects	0.068	0.026	0.017	0.122	0.006
	Standardized Direct Effects	0.245	0.072	0.120	0.400	0.007

Furthermore, the 95% confidence interval of the direct effect of NS on the REML is [−0.054, 0.213], and, for NC on the REML, it is [−0.052, 0.159]. These intervals suggest that the complete mediation effect is also significant. That is to say, the impact of NS and NC on the REML is entirely attributable to KI. This supports the establishment of assumptions H1c and H2c.

Moving on to the mediation effect of T and R on the REML, the results from Table 9 show that the 95% confidence interval for the indirect effect of T on the REML is [0.016, 0.126], and, for R on the REML, it is [0.017, 0.122]. Since neither interval includes 0, we can conclude that the mediation effect is significant. Additionally, the 95% confidence interval of the direct effect of T on the REML is [0.100, 0.347], and, for R on the REML, it is [0.120, 0.400]. These intervals do not encompass zero; hence, they represent a partial mediating effect.

In the case of the mediating effect of KI between T and the REML, the indirect effect value is 0.068, the direct effect value is 0.220, and the total effect value is 0.288. The ratio of the indirect effect to the total effect is 0.236, so, when T exerts an influence on the REML, 23.6% of the variance is accounted for by KI. Therefore, assumption H3c holds.

In mediating the effect of KI between R and the REML, the indirect effect value is 0.068, the direct effect value is 0.245, and the total effect value is 0.313. The ratio of the indirect effect to the total effect is 0.217, so, when R affects the REML, 21.7% of the variance is attributable to KI. Therefore, assumption H4c holds.

5. Discussion and Conclusions

5.1. Discussion

The testing of all the research hypotheses is shown in Table 10. In general, most of the research hypotheses are supported, except H1b and H2b.

Table 10. Summary of hypotheses.

Hypothesis	Hypothesis Relationship	Supported
H1a	NS has a significant positive effect on KI	Yes
H1b	NS has a significant positive effect on REML	No
H1c	KI has a significant mediating effect between NS and REML	Yes
H2a	NC has a significant positive effect on KI	Yes
H2b	NC has a significant positive effect on REML	No
H2c	KI has a significant mediating effect between NC and REML	Yes
H3a	T has a significant positive effect on KI	Yes
H3b	T has a significant positive effect on REML	Yes
H3c	KI has a significant mediating effect between T and REML	Yes
H4a	R has a significant positive effect on KI	Yes
H4b	R has a significant positive effect on REML	Yes
H4c	KI has a significant mediating effect between R and REML	Yes
H5	KI has a significant positive effect on REML	Yes

This study focuses on emergency medical logistics organizations as the main research object. It utilizes social capital theory embedded in the relational network to comprehensively and systematically analyze the role and impact of social capital on the robustness of emergency medical logistics. The study also examines the intermediary effect of knowledge integration. By employing normative analytical methods such as theoretical deduction, hypothesis formulation, model construction, and empirical testing, this study clarifies the impact of social capital and knowledge integration on the robustness of emergency medical logistics.

According to the essential attributes of the emergency medical logistics network and the increasingly prominent role of social capital in emergency organizations, this study divides the social capital embedded in the emergency organization relationship network into four impact factors: NS, NC, T, and R. Through a systematic review of the existing domestic and foreign research on social capital theories, mainly following the ideas of [8], these four factors are used as the scale measurement of social capital. The scale demonstrates good reliability and validity through empirical testing.

The empirical results indicate that network size and network centrality indirectly affect the robustness of emergency medical logistics through the intermediate variable of knowledge integration, but they do not have a direct effect. Merely constructing a

large-scale and stable emergency organization network does not necessarily enhance the emergency response capabilities of the member organizations. Only through activities such as knowledge integration can the member organizations enhance their business capabilities within the emergency organization network, thereby enhancing the robustness of emergency medical logistics. In summary, the role of knowledge integration as an intermediary unlocks the intrinsic value and potential of the emergency organization network.

According to the statistics in the previous chapter, NS and NC are at a low level of influence on the REML, and, overall, there are several other noteworthy issues. First, the size of the network is too large. A large NS requires more time and effort but cannot effectively form a collective force. Therefore, a network of emergency response organizations with complementary capacities and an appropriate size should be formed scientifically. The member organizations are a key factor in determining the efficiency of an emergency organization network. According to the strategic objectives of the network, a group of partners with complementary and compatible capabilities should be selected. Second, the central position of emergency organizations is not prominent enough. Although the members of the emergency response organization have relevant functions assigned to them, the central position of the emergency organization needs to be improved as it is on an equal footing with many of its members in the administrative system, and it is difficult to mobilize resources from other departments at critical moments. Therefore, the central position of emergency organizations should be strengthened through rules and regulations. On the one hand, improving the rules and regulations is an important guarantee for establishing an emergency organization network with orderly command and smooth instruction. Through supporting rules and regulations and implementation measures to standardize the responsibility, function, rights, and other relations of the emergency network departments, the network centrality of the emergency organization in the system can be strengthened. Third, the form of the emergency network is greater than the substance. After some local emergency networks were built according to the requirements of superiors, there was little business communication and work contact between the member organizations, resulting in difficulty in responding and dealing with emergencies in a timely manner. The interaction among the member organizations should be strengthened. Interaction among member organizations is an important element of social capital operation. It is possible for members to participate in emergency response drills, which not only improves the operational capacity of emergency response organizations to deal with emergencies but also smooths out the capacity differences between the member organizations and increases the sense of belonging among them.

Trust and regulation both have direct and indirect effects on the robustness of emergency medical logistics through knowledge integration. Trust and regulation facilitate mutual aid among member organizations and enable emergency organizations to obtain aid in anomalous circumstances. Additionally, they assist member organizations in conducting more in-depth and productive learning exchanges. So, we need to strengthen the following two areas.

First, at the initial stage of the establishment of an organizational network, the members of each organization should fully demonstrate their mutual trust and their sincerity in collaborating with each other. The second aspect is to promote the formation of normative mechanisms. In order to rationalize the behavior of each member organization and insist on the overall interests, it is necessary to establish a set of normative mechanisms within the network that discourage mutual deception and prevent opportunistic behavior.

Sun et al. (2022) measure the relationship between organizational knowledge integration ability and innovation performance, confirming that knowledge integration has a positive impact on organizational innovation [9]. Therefore, this study posits that improving knowledge integration ability is crucial for emergency medical logistics organizations to adapt to environmental changes and maintain competitiveness [50]. The measurement of knowledge integration is based on the viewpoint of Nevis, DiBella, and Gould (1995) [43],

and the scale demonstrates good reliability and validity through empirical testing. Through knowledge integration, organizational members can effectively utilize scattered and disordered knowledge resources obtained from external sources, form their own knowledge system, and enhance their emergency response capabilities [51].

In addition, in the field of emergency management, unpredictable and unexpected events can occur at any time, and there is often a large time lag between the new situation on the scene and the command's decision-making instructions. In many cases, sitting back and waiting for the command's orders or the strict implementation of the previous course of action will cause serious delays in the emergency response, even causing major losses. As a result, the authorization of front-line personnel should be appropriately increased to strengthen the level and capacity of autonomous decision-making. First, front-line personnel should be allowed to learn in depth about the emergency response tasks, objectives, and basic principles of the organizational network. Secondly, action guidelines for autonomous decision-making by member organizations or individuals should be formulated, clarifying the prerequisites for autonomous decision-making in emergencies, the direction of application, the degree of autonomy, and important matters. In addition, front-line personnel should be allowed to obtain relevant information necessary for autonomous decision-making, such as rescue forces, support forces, equipment and facilities, and regarding the climatic environment; at the same time, front-line personnel should be allowed to procure the necessary equipment and facilities independently within a certain range. In addition, front-line personnel should be tolerated, within certain limits, regarding making mistakes in order to accomplish the mission objectives.

Furthermore, equipment, facilities, and power are the material basis for the operation of an emergency organization. In the event of damage, they should be repaired as quickly as possible or backed up off-site in advance.

5.2. Conclusions

5.2.1. Theoretical Implication

Drawing on the latest thinking regarding the introduction of knowledge integration, the impact of social capital on the REML is analyzed from a KI perspective, defining the REML on the one hand as the ability of emergency organizations to perceive and respond to emergencies by integrating knowledge resources. In order to cope with various emergencies, it is proposed that emergency organizations must continuously update their capabilities and develop new knowledge through the method of KI. This definition is conducive to promoting the integration of the REML and KI research, providing a theoretical basis for more in-depth research and the application of emergency response organization capabilities.

This study presents a conceptual model and a measurement scale to enhance the understanding of the robustness of emergency medical logistics. The proposed model explores the impact of social capital, embedded within the organizational field, on organizational capabilities through knowledge management. Furthermore, an analytical framework, referred to as "the association mechanism of social capital, knowledge integration among emergency organizations, and the robustness of emergency medical logistics", is developed.

This paper applies social capital, knowledge integration, REML theories, analyzes the interplay between social capital, knowledge integration, and the REML, expands the field of social capital, knowledge integration, REML theories, enriches the theory of emergency organization strategy, and improves and develops the REML theories. The research not only expands on and extends the previous theories and enriches the research content of emergency organization capability but also captures the immediate problems of emergency organization capability, presenting certain reference value for the subsequent research.

5.2.2. Practical Implications

Based on the impact of social capital and knowledge integration on the robustness of emergency medical logistics and the relationship model, a questionnaire was developed

for a large-scale survey. The questionnaire and the proposed theory were analyzed using members of emergency organizations in Henan Province, China, as the subjects of the empirical research. The results show that only by using social capital as a strategic resource can emergency organizations maintain regular operation when emergencies occur, and consequently the REML can be guaranteed. In addition, through the intermediary effect of knowledge integration, the role of social capital can be effectively promoted, and the REML can be improved. At the governance level, this study can provide a reference for the policy formulation of the relevant departments, and, at the micro-subject level, it can depict the picture of the whole industry, guide the external strategy formulation of individual organizations, as well as provide suggestions for the internal management of the organizations.

China comprehensively launched the emergency management system construction work rather recently. In the face of the domestic security facing a severe situation and the complexity of the situation, the current emergency management system has been exposed to several problems, and the construction of China's emergency management system has brought about a brand-new challenge. For this reason, this paper researches the emergency management system based on the perspective of the REML and the construction of the robustness of emergency management system, which has realistic guiding significance to better deal with complex and diversified emergencies under the new situation.

5.2.3. Originality

The research perspective of this paper is novel. This study takes the REML as the perspective and the emergency organizations as the research objects. By utilizing structural equation modeling, the influence of social capital on knowledge integration and its role in promoting the robustness of emergency medical logistics are discussed.

In the field of emergency medical logistics, this study discusses the relationship between knowledge integration and the REML for the first time. This analysis validates emergency medical logistics organizations' need to improve their knowledge integration ability in order to improve the REML.

5.2.4. Limitations and Future Research Prospects

This article utilizes the questionnaire survey method, where respondents provide answers based on their subjective knowledge. However, the inclusion of personal principles introduces a degree of subjectivity, which diminishes the validity of the analysis results. Furthermore, the study is limited to one province in China due to resource constraints and pragmatic considerations. While the sample data meet the research requirements, the generalizability of the conclusions may still require confirmation. Additionally, the model construction requires improvement. The concept of robustness in emergency medical logistics is challenging to operationalize, and there are limited references available. Therefore, the structural equation model used in this study is relatively straightforward, with only knowledge integration as an intermediate variable and only four independent variables being studied.

In the next stage, it will be necessary to expand the scope and quantity of the samples. The sampling should be conducted independently in multiple regions of China, and each emergency organization should collect a minimum number of responses. Additionally, the empirical method, combining survey questionnaires with interviews, should be utilized. The second step is to refine the concept model for research. Through in-depth theoretical research, future studies should identify additional intermediate variables and independent variables that influence social capital and the robustness of emergency medical logistics.

Author Contributions: Conceptualization, H.J. and Z.C.; Methodology, X.Z.; Investigation, J.L. and Z.C.; Data curation, X.Z. and Z.C.; Writing—original draft, Z.C.; Writing—review and editing, J.Z. and Z.C.; Visualization, J.Z. All authors have read and agreed to the published version of the manuscript.

Funding: This work was supported by the project "Research on logistics knowledge management systems from the perspective of tacit knowledge" (SKHX-2021-0169).

Data Availability Statement: The data from this study are already in the figures and tables in the paper. Further inquiries can be directed to the corresponding author.

Acknowledgments: The manuscript has been read and approved by all named authors and that there are no other persons who satisfied the criteria for authorship but are not listed.

Conflicts of Interest: The authors declare no conflicts of interest.

Appendix A

Table A1. Harman results of single-factor test.

Component	Initial Eigenvalues			Extraction Sums of Squared Loadings		
	Total	% of Variance	Cumulative %	Total	% of Variance	Cumulative %
1	9.324	42.381	42.381	9.324	42.381	42.381
2	1.873	8.514	50.895	1.873	8.514	50.895
3	1.599	7.268	58.163	1.599	7.268	58.163
4	1.336	6.071	64.234	1.336	6.071	64.234
5	1.267	5.761	69.995	1.267	5.761	69.995
6	1.135	5.161	75.156	1.135	5.161	75.156
7	0.521	2.367	77.523			
8	0.463	2.104	79.627			
9	0.439	1.994	81.622			
10	0.428	1.947	83.568			
11	0.392	1.780	85.348			
12	0.369	1.678	87.027			
13	0.358	1.625	88.652			
14	0.345	1.567	90.219			
15	0.338	1.536	91.755			
16	0.329	1.495	93.249			
17	0.302	1.373	94.623			
18	0.272	1.236	95.859			
19	0.264	1.202	97.061			
20	0.233	1.061	98.122			
21	0.211	0.960	99.082			
22	0.202	0.918	100.000			

Appendix B. Questionnaire

We are students at the School of Management of Zhengzhou University. We are conducting research on the robustness of emergency medical logistics. Hopefully, your answers to the following questions in the questionnaire will help us to better understand the specific situation of the development of emergency organizations. This survey is for academic research only and will not involve the confidentiality of your institution, and we guarantee that the content you fill in will be strictly confidential. For each of the following questions, please check ($\surd$) directly in the appropriate place. Thank you for your assistance.

First part: Basic Information

1. Please select your gender.
   a. Male ( )
   b. Female ( )
2. What is your education background?
   a. Junior college and below ( )
   b. Bachelor's degree ( )
   c. Master's degree and above ( )
3. What is your organization type?

a. Government departments ( )
b. Hospital ( )
c. Social groups ( )
d. Enterprise ( )

Second part: Please judge the actual situation of your organization according to the description of each item

1. Network Size	Totally Disagree	Basically Disagree	Uncertainty	Basically Agree	Quite Agree
a. Your company has a large emergency network.	1	2	3	4	5
b. Your organization has a large number of emergency network connections (both direct and indirect).	1	2	3	4	5
c. Members of your organization's emergency network vary widely.	1	2	3	4	5

2. Network Centrality	Totally Disagree	Basically Disagree	Uncertainty	Basically Agree	Quite Agree
a. Your organization has a strong ability to influence the member organizations in the emergency network.	1	2	3	4	5
b. Your organization is able to coordinate and organize other forces smoothly.	1	2	3	4	5
c. Establish a relatively smooth and effective communication mechanism and platform between your organization and network members.	1	2	3	4	5

3. Trust	Totally Disagree	Basically Disagree	Uncertainty	Basically Agree	Quite Agree
a. There is a high level of trust between your organization and other emergency network member organizations.	1	2	3	4	5
b. Your organization believes that other member organizations can be relied upon.	1	2	3	4	5
c. Your organization itself has a good reputation, a strong sense of maintaining relationships, and a high degree of trustworthiness.	1	2	3	4	5

4. Regulation	Totally Disagree	Basically Disagree	Uncertainty	Basically Agree	Quite Agree
a. There is mutual respect and recognition between your organization and the member organizations of emergency network.	1	2	3	4	5
b. Your organization has developed a sound cooperation policy.	1	2	3	4	5
c. In case of violation, your organization and the network member organizations will be punished with loss of credibility.	1	2	3	4	5

5. Knowledge Integration	Totally Disagree	Basically Disagree	Uncertainty	Basically Agree	Quite Agree
a. Your organization can effectively integrate knowledge created internally with knowledge acquired externally.	1	2	3	4	5
b. Your organization can effectively integrate the knowledge of different departments, teams, or individuals within the organization.	1	2	3	4	5
c. Your organization can effectively integrate knowledge belonging to different technologies or application areas.	1	2	3	4	5
d. Your organization can effectively integrate newly acquired knowledge with existing knowledge.	1	2	3	4	5
e. Your organization is able to make effective changes to its internal organizational structure or operational processes.	1	2	3	4	5

6. Robustness of Emergency Medical Logistics	Totally Disagree	Basically Disagree	Uncertainty	Basically Agree	Quite Agree
a. In an emergency, your organization's front-line personnel have a high degree of autonomy to deal with sudden problems.	1	2	3	4	5
b. In response to unexpected events, under a certain amount of time and risk pressure, rapid and spontaneous on-the-spot disposal ability is very strong.	1	2	3	4	5
c. With no advance preparation and no additional assistance, the ability to creatively integrate existing resources to deal with new problems is strong.	1	2	3	4	5
d. Pay attention to the maintenance of emergency facilities and equipment and build a rush repair mechanism.	1	2	3	4	5
e. Focus on updating the stock of drugs and consumables.	1	2	3	4	5

References

1. Qu, Z.; Wang, F.; Chen, X.; Wang, X.; Zhou, Z. Rapid Report of Seismic Damage to Hospitals in the 2023 Turkey Earthquake Sequences. *Earthq. Res. Adv.* **2023**, *3*, 100234. [CrossRef]
2. Friday, D.; Savage, D.A.; Melnyk, S.A.; Harrison, N.; Ryan, S.; Wechtler, H. A Collaborative Approach to Maintaining Optimal Inventory and Mitigating Stockout Risks during a Pandemic: Capabilities for Enabling Health-Care Supply Chain Resilience. *J. Humanit. Logist. Supply Chain Manag.* **2021**, *11*, 248–271. [CrossRef]
3. Tønnessen, Ø.; Dhir, A.; Flåten, B.T. Digital Knowledge Sharing and Creative Performance: Work from Home during the COVID-19 Pandemic. *Technol. Forecast. Soc. Chang.* **2021**, *170*, 120866. [CrossRef]
4. He, Y.; Liu, N. Methodology of Emergency Medical Logistics for Public Health Emergencies. *Transp. Res. Part E Logist. Transp. Rev.* **2015**, *79*, 178–200. [CrossRef] [PubMed]
5. Kovács, G.; Spens, K.M. Humanitarian Logistics in Disaster Relief Operations. *Int. J. Phys. Distrib. Logist. Manag.* **2007**, *37*, 99–114. [CrossRef]
6. Khan, J.; Javed, B.; Mubarak, N.; Bashir, S.; Jaafar, M. Psychological Empowerment and Project Success: The Role of Knowledge Sharing. *IEEE Trans. Eng. Manag.* **2022**, *69*, 2997–3008. [CrossRef]
7. Nahapiet, J.; Ghoshal, S. Social Capital, Intellectual Capital, and the Organizational Advantage. *Acad. of Manag. Rev.* **1998**, *23*, 242–266. [CrossRef]
8. Putnam, R. *Bowling Alone*; Simon & Schuster: New York, NY, USA, 2000.
9. Sun, X.; Zhao, D.; Zhang, D.; Tian, F. Entrepreneurship and Sustainable Innovation Capabilities in Platform Enterprises: The Mediating Role of Knowledge Integration. *Chinese Manag. Stud.* **2022**, *16*, 627–652. [CrossRef]

10. Lai, Y.; Hsu, M.; Lin, F.; Chen, Y.; Lin, Y. The Effects of Industry Cluster Knowledge Management on Innovation Performance. *J. Bus. Res.* **2014**, *67*, 734–739. [CrossRef]
11. Yutian, J.; Wenzhi, G.; Xiaoning, S. Research Progress of Emergency Knowledge Management for Natural Disasters. *J. Mod. Inf.* **2023**, *43*, 167–177.
12. Wang, N.; Wang, L.; Ma, Z.; Wang, S. From Knowledge Seeking to Knowledge Contribution: A Social Capital Perspective on Knowledge Sharing Behaviors in Online Q&A Communities. *Technol. Forecast. Soc. Chang.* **2022**, *182*, 121864. [CrossRef]
13. Singh, S.K.; Mazzucchelli, A.; Vessal, S.R.; Solidoro, A. Knowledge-Based HRM Practices and Innovation Performance: Role of Social Capital and Knowledge Sharing. *J. Int. Manag.* **2021**, *27*, 100830. [CrossRef]
14. Wang, M.; Wang, Y.; Mardani, A. Empirical Analysis of the Influencing Factors of Knowledge Sharing in Industrial Technology Innovation Strategic Alliances. *J. Bus. Res.* **2023**, *157*, 113635. [CrossRef]
15. Thomas, A.; Gupta, V.; Riso, T.; Briamonte, M.F.; Usai, A.; Fiano, F. Enhancing Innovative Behavior at the Workplace: The Moderating Role of Entrepreneurial Orientation and Web 2.0. In Proceedings of the 2021 IEEE International Conference on Technology Management, Operations and Decisions (ICTMOD), Marrakech, Morocco, 24–26 November 2021; pp. 1–8. [CrossRef]
16. Swanson, E.; Kim, S.; Lee, S.M.; Yang, J.J.; Lee, Y.K. The Effect of Leader Competencies on Knowledge Sharing and Job Performance: Social Capital Theory. *J. Hosp. Tour. Manag.* **2020**, *42*, 88–96. [CrossRef]
17. Sukoco, B.M.; Hardi, H.; Qomariyah, A. Social Capital, Relational Learning, and Performance of Suppliers. *Asia Pac. J. Mark. Logist.* **2018**, *30*, 417–437. [CrossRef]
18. Mura, M.; Lettieri, E.; Radaelli, G.; Spiller, N. Promoting Professionals' Innovative Behaviour through Knowledge Sharing: The Moderating Role of Social Capital. *J. Knowl. Manag.* **2013**, *17*, 527–544. [CrossRef]
19. Reuter-Oppermann, M.; Berg, P.L.V.D.; Vile, J.L. Logistics for Emergency Medical Service systems. *J. Health Syst.* **2017**, *6*, 187–208. [CrossRef]
20. Negi, S.; Negi, G. Framework to Manage Humanitarian Logistics in Disaster Relief Supply Chain Management in India. *Int. J. Emerg. Serv.* **2021**, *10*, 40–76. [CrossRef]
21. Kapucu, N.; Arslan, T.; Demiroz, F. Collaborative Emergency Management and National Emergency Management Network. *Disaster Prev. Manag. Int. J.* **2010**, *19*, 452–468. [CrossRef]
22. Rojas Trejos, C.A.; Meisel, J.D.; Adarme Jaimes, W. Humanitarian Aid Distribution Logistics with Accessibility Constraints: A Systematic Literature Review. *J. Humanit. Logist. Supply Chain Manag.* **2023**, *13*, 26–41. [CrossRef]
23. Xiong, J.; Feng, C.; Zhang, Y. Robustness Analysis of Disaster Relief Logistics Network Based on Complex Networks. *J. Syst. Simul.* **2013**, *25*, 1639–1645. [CrossRef]
24. Miao, B.; Liang, Y.; Suo, Y. The Influence of Organizational Social Network on Enterprise Collaborative Innovation-Mediating Role of Knowledge Sharing and Moderating Effect of Digital Construction. *IEEE Access* **2023**, *11*, 5110–5122. [CrossRef]
25. Rosell, D.T.; Lakemond, N.; Melander, L. Integrating Supplier Knowledge in New Product Development Projects: Decoupled and Coupled Approaches. *J. Knowl. Manag.* **2017**, *21*, 1035–1052. [CrossRef]
26. Szász, L.; Scherrer-Rathje, M.; Deflorin, P. Benefits of Internal Manufacturing Network Integration: The Moderating Effect of Country Context. *Int. J. Oper. Prod. Manag.* **2016**, *36*, 757–780. [CrossRef]
27. Tsai, W. Knowledge Transfer in Intraorganizational Networks: Effects of Network Position and Absorptive Capacity on Business Unit Innovation and Performance. *Acad. Manag. J.* **2001**, *44*, 996–1004. [CrossRef]
28. Tsai, W.; Ghoshal, S. Social Capital and Value Creation: The Role of Intrafirm Networks. *Acad. Manag. J.* **1998**, *41*, 464–476. [CrossRef]
29. Imam, H.; Zaheer, M.K. Shared Leadership and Project Success: The Roles of Knowledge Sharing, Cohesion and Trust in the Team. *Int. J. Proj. Manag.* **2021**, *39*, 463–473. [CrossRef]
30. Radtke, R.R.; Speklé, R.F.; Widener, S.K. Flourish or Flounder: Do Trust-Centric Management Controls Encourage Knowledge Sharing and Team Performance? *Account. Organ. Soc.* **2023**, *107*, 101429. [CrossRef]
31. Salam, M.A.; Khan, S.A. Lessons from the Humanitarian Disaster Logistics Management: A Case Study of the Earthquake in Haiti. *Benchmarking* **2020**, *27*, 1455–1473. [CrossRef]
32. Chen, L.; Liu, Y.; Hu, S.; Zhang, S. Perception of Organizational Politics and Innovative Behavior in the Workplace: The Roles of Knowledge-Sharing Hostility and Mindfulness. *J. Bus. Res.* **2022**, *145*, 268–276. [CrossRef]
33. Shi, L.; Chen, S.; Zhou, Y. The Influence of Social Capital on Primary School Teachers' Creative Teaching Behavior: Mediating Effects of Knowledge Sharing and Creative Teaching Self-Efficacy. *Think. Ski. Creat.* **2023**, *47*, 101226. [CrossRef]
34. Yan, Y.; Peng, Z.; Zha, X. Transactive Memory System (TMS) and Knowledge Sharing: The Effects of Social Capital and Task Visibility. *Libr. Inf. Sci. Res.* **2023**, *45*, 101233. [CrossRef]
35. Han, Y.; Chen, G. The Relationship between Knowledge Sharing Capability and Innovation Performance within Industrial Clusters: Evidence from China. *J. Chinese Econ. Foreign Trade Stud.* **2018**, *11*, 32–48. [CrossRef]
36. Lin, R.; Wang, L. The Impact of Knowledge Integration Capability on Radical Innovation Based on Exploratory Innovation: The Moderating Effect of Absorptive Capacity and Innovation Openness. *Sci. Technol. Manag. Res.* **2023**, *43*, 19–27. [CrossRef]
37. Ayoub, H.F.; Abdallah, A.B.; Suifan, T.S. The Effect of Supply Chain Integration on Technical Innovation in Jordan: The Mediating Role of Knowledge Management. *Benchmarking* **2017**, *24*, 594–616. [CrossRef]
38. Li, B.; Wan, J.; Qi, L.; Hang, J. Unveiling the Role of Knowledge Management Capabilities in Strategic Emergency Response: Insights from the Impact of COVID-19 on China's New Economy Firms. *J. Knowl. Manag.* **2023**, *27*, 47–58. [CrossRef]

39. Chen, S.; Hui, Q.; Wang, J. The Influencing Mechanism of Hainan Logistics Industry within Open Innovation—Taking Knowledge Integration Capability as a Moderator. *Sci. Technol. Manag. Res.* **2013**, *33*, 143–146.
40. Alam, S.; Zhang, J.; Ali, A. The Mechanism of Knowledge Management Process toward Minimizing Technical Risks under Green Implementation Network: A Direct and Configurational Approach. *J. Manuf. Technol. Manag.* **2023**, *34*, 937–960. [CrossRef]
41. Putnam, R.D. Bowling alone: America's declining social capital. *J. Democr.* **1995**, *6*, 65–78. [CrossRef]
42. Chiu, C.M.; Hsu, M.H.; Wang, E.T.G. Understanding Knowledge Sharing in Virtual Communities: An Integration of Social Capital and Social Cognitive Theories. *Decis. Support Syst.* **2006**, *42*, 1872–1888. [CrossRef]
43. Nevis, E.C.; DiBella, A.J.; Gould, J.M. *Organizations as Learning Systems*; Butterworth-Heinemann: Oxford, UK, 1995; Volume 36. [CrossRef]
44. Mallak, L. Putting Organizational Resilience to Work. *Ind. Manag. Norcross Georg.* **1998**, *40*, 8–13.
45. Somers, S. Measuring Resilience Potential: An Adaptive Strategy for Organizational Crisis Planning. *J. Contingencies Cris. Manag.* **2009**, *17*, 12–23. [CrossRef]
46. Podsakoff, P.M.; MacKenzie, S.B.; Lee, J.Y.; Podsakoff, N.P. Common Method Biases in Behavioral Research: A Critical Review of the Literature and Recommended Remedies. *J. Appl. Psychol.* **2003**, *88*, 879–903. [CrossRef]
47. Alam, S.; Zhang, J.; Shehzad, M.U.; Khan, N.; Ali, A. Mediation Approach of Knowledge Management Process towards Supply Chain Performance under Green Technology: An Empirical Analysis. *Bus. Process Manag. J.* **2023**, *29*, 1466–1490. [CrossRef]
48. Shrout, P.E.; Bolger, N. Mediation in Experimental and Nonexperimental Studies: New Procedures and Recommendations. *Psychol. Methods* **2002**, *7*, 422–445. [CrossRef]
49. Soti, V.; Pratap, S.; Dwivedi, A.; Lakshay. A Structural Equation Modeling Framework for Studying Sustainable Freight Transportation Indicators in Emerging Economies. *Decis. Anal. J.* **2023**, *9*, 100337. [CrossRef]
50. Boamah, F.A.; Zhang, J.; Danso, N.A.A.; Alam, S.; Naqvi, K.; Tariq, M. Predicting the Reward System of Knowledge Sharing in the Industrialized Engineering Sector Based on Regulatory Mechanisms. *Iran. J. Sci. Technol.-Trans. Civ. Eng.* **2023**, *47*, 3199–3210. [CrossRef]
51. Alam, S.; Zhang, J.; Khan, N.; Dandan, W. Mechanism of Green and Knowledge Process toward Minimizing Innovation Risks: A Direct and Configuration Approach. *Bus. Strateg. Environ.* **2024**, *in press*. [CrossRef]

Disclaimer/Publisher's Note: The statements, opinions and data contained in all publications are solely those of the individual author(s) and contributor(s) and not of MDPI and/or the editor(s). MDPI and/or the editor(s) disclaim responsibility for any injury to people or property resulting from any ideas, methods, instructions or products referred to in the content.