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Critical success factors to support organizational innovation performance: Linking Strategic Alliance and Knowledge Management

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Abstract

This research study explores the effects of strategic alliances on knowledge management and organizational innovation performance. The study commences with an extensive literature review to identify critical success factors, followed by a step-by-step approach using the modified total interpretive structural modeling (M-TISM) technique. This approach is used to examine the interrelationships between the identified factors and develop a hierarchical structural model for organizational innovation performance. The study identifies critical success factors such as knowledge management, organizational learning, top management support, strategic alliances, technological knowledge, alliance experience, training and skill development, and absorption capacity to evaluate their impact on organizational innovation performance. The study concludes that top management support is a crucial factor in determining innovation performance within organizations, as it plays a vital role in strategic alliances and knowledge management.

Keywords: Innovation performance, strategic alliance, Knowledge management, TISM

Track: Innovation

Word Count: 5163 [excluding tables and references]

1. Introduction

Organizational innovation is a significant source of competitive advantage and can improve organizational performance. Generally, it pertains to innovative management initiatives at the organizational level. This can be defined as the implementation of new products, processes, or services in business practices or external relations of the company (Sengupta, 2014). The scope of organizational innovation encompasses a wide range of activities such as developing new products and procedures, enhancing organizational structures, refining administrative and managerial procedures, and creating novel knowledge management systems to enhance organizational performance (Hameed et al., 2012, Tidd, 2001). Innovation performance of an organization can be measured by the number of patents filed by the organization (Chemmanur et al., 2023). According to earlier research, organizational innovation results from repurposing already-existing knowledge and abilities (An et al., 2014; Dereli, 2015). Therefore, organizational learning, knowledge and skills is necessary for organizational innovation. This acts as a substantial input into the process of developing new knowledge and new products as well as enhanced organizational performance (Ottenbacher, 2007). For this reason, strategic alliances and business partnerships are frequently regarded as a crucial source of organizational innovation that enables organizations to acquire outside knowledge, and technical capabilities complement their existing resources and aid in gaining access to competencies, technologies, and skills (Al-Jabri and Al-Busaidi, 2018; Geurts et al., 2022; Köhler et al., 2022). Organization's reputation, experience, government support, complementarity of knowledge and resources are few of the factors which help in selecting the right partner for alliance (Esmaelnezhad et al., 2023). The majority of the literature on strategic alliances and innovation management is grounded in a knowledge-based perspective on the organization, which emphasizes that knowledge is a pivotal resource for organizational innovation, performance, and survival (Carneiro, 2000). Resource based theory is another widely used approach in the domain of strategic alliance and innovation. In recent decades, scholarly research on alliance formation in the context of organizational innovation has received a considerable amount of attention. Several studies have looked at how strategic alliances as a whole affect innovative outcomes as well as the fundamental forces behind organizational innovation (Al Lily, 2016). However, research on understanding the impact of strategic alliances on knowledge management and the success of innovation is very limited.

1.1 Research gaps, questions, and objectives

Strategic alliances can enhance organizational innovation performance by providing the opportunity to acquire new knowledge, technical capabilities, and other valuable resources that exist beyond organizational boundaries (Cui and O'Connor, 2012). Various studies already examined the correlation of following factors on innovation: inter-organizational networks (i.e., joint ventures, alliances, collaborations), international diversification, technical background of employees, partner technical competence, technical capability, inter-firm learning, dynamic capability, knowledge transfer, cooperation, partnership, entrepreneurship, knowledge flow, leadership (Bercovitz, and Feldman, 2007) etc. Several research studies have explored the impact of strategic alliances on organizational innovation, focusing on intermediary factors like knowledge transfer, organizational climate (Ogbonna and Harris, 2000; Singh et al., 2020), knowledge management (Carneiro, 2000), flexibility, absorptive capacity, skill development,

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organizational learning (Hurley and Hult, 1998; Alegre and Chiva 2008), top management support (Paul and Axel, 2003; Gumusluoglu, 2009), prior alliance experience (Marte et al., 2020; Osiyevskyy and Dewald, 2015; Daveri and Parisi, 2015), information flow, training (Michaelis and Markham, 2017; Antonioli and Della Torre, 2015), trust (Blomqvist et al., 2005; Bstieler et al., 2015), and skill development (Doran and Ryan, 2014; Toner, 2011). However, the understanding of knowledge management processes and the inter-relationship among factors through which organizational innovation can be improved using the intermediate effects of strategic alliances is still limited and largely fragmented in the literature. Therefore, this study aims to fill a significant research gap in the literature, which is the lack of attention to how strategic alliances can aid knowledge management and improve organizational innovation. Recent studies by Paredes-Frigolett and Pyka (2017) and Lee et al. (2018) have highlighted the limited understanding of organizational innovation after strategic alliances. There has been a dearth of studies examining the contextual relationship between critical success factors and developing a hierarchical structure of factors regarding strategic alliances and organizational innovation. Drawing from the knowledge-based view of the firm, this study seeks to analyze the impact of strategic alliance on organizational innovation performance. The study identifies and analyzes the factors which impact the organizational innovation performance and addresses the following research questions: 1) What is the current state of organizational innovation research in relation to the literature on strategic alliances and knowledge management? 2) How can strategic alliances enhance knowledge management and improve organizational innovation performance?

To address the aforementioned research questions, the research objectives of this study are to: (1) identify the critical success factors influencing knowledge management and organizational innovation performance after strategic alliances, (2) analyze the interrelationships between these identified critical factors, and evaluate the priority of each identified factor, and (3) develop a hierarchical structural model based on identified critical success factors that illustrate the organizational innovation performance phenomena through strategic alliances and knowledge management. In this study, the literature analysis led to the identification of eight critical success factors. The hierarchical structural model is developed by the use of the modified total interpretive structural modeling (m-TISM) approach. The developed hierarchical structural model and its associated linkages between factors have been validated by industry experts from the service and manufacturing sectors of India. Finally, theoretical and managerial implications are derived to assist the various stakeholders in effectively managing knowledge and organizational innovation.

The paper is structured as follows: the next section provides a comprehensive overview of the theoretical background and critical success factors of organizational innovation in strategic alliances. The third section discusses the research methodology used in this study. The results of the research will be presented in the subsequent section, followed by the findings. The limitations of the study and opportunities for future research will be addressed in the next section. Lastly, the concluding section will present the theoretical contributions and managerial implications of the study.

2. Literature Review

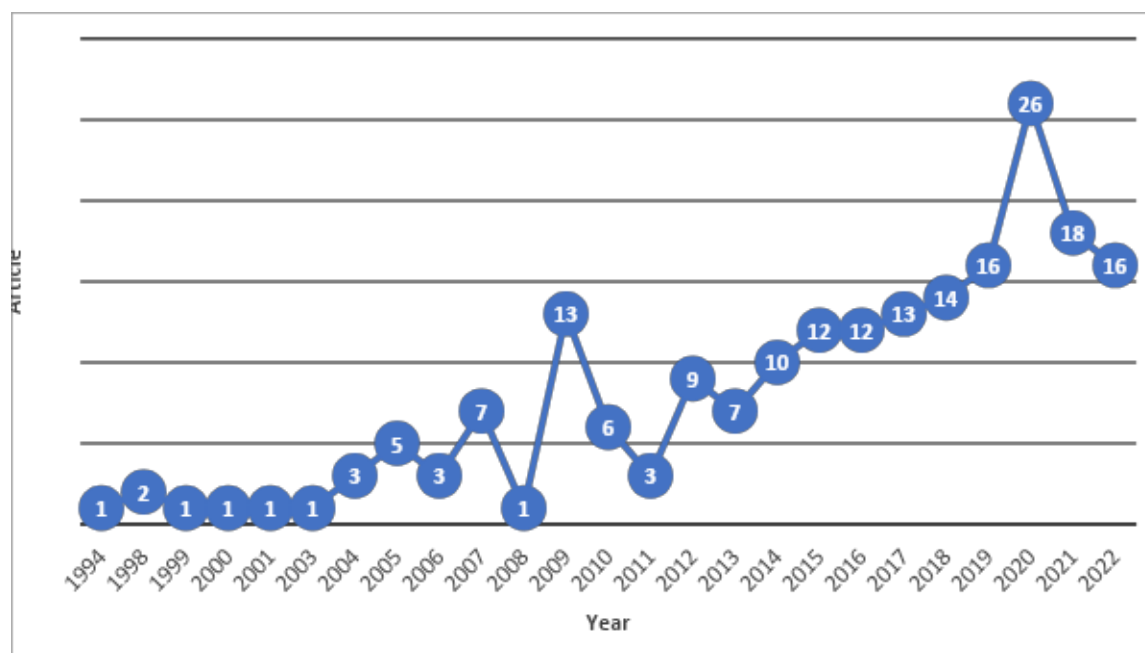
2.1 Literature search and article selection

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The pertinent research articles were identified by a search of the Scopus database of peer-reviewed literature using the following keywords: (“knowledge management” OR “knowledge creation” OR “knowledge access” OR “knowledge acquisition” OR “knowledge adoption” OR “knowledge management system” OR “knowledge sharing” OR “knowledge dissemination” OR “knowledge transfer” OR “knowledge retrieval” OR “learning”) AND (“strategic allianc*” OR “joint ventur*” OR “joint-ventur*” OR “inter-firm partnership*” OR “inter-organizational partner*” OR “collaboration*” OR “firm partnership” OR “firm collaboration” OR “interfirm” OR “inter-firm” OR “interorganizational” OR “inter-organizational”) AND (“organizational innovation” OR “innovation*” OR “organizational-innovation” OR “management innovation”). We selected the Scopus database to choose the research articles for this study because it is the largest abstract and citation database and is more popular (Harzing and Alakangas, 2016) because of its dependability, user-friendly interface, and availability of various sorting and refining functions. The first step in our research involved a keyword-based search, which resulted in 5743 papers. Next, we limited the search results to articles in the English language and the field of business and management, leaving us with a filtered sample of 1229 articles. These articles were then subjected to a screening phase that involved reviewing and discarding abstracts that were not related to strategic alliances, knowledge management, and organizational innovation. We ensured the quality of the articles by only including those from journals listed by the Australian Business Deans Council (ABDC). As a result, the 201 research articles that covered the 27-year period from 1994 to 2022 were included in the final sample and were used to examine research trends and identify critical success factors for the study.

2.2 General trends in literature

The research trend in the 201 articles published between 1994 and 2022 is shown in Figure 1. It shows several research article production peaks over a 27-year period. The number of research articles significantly increased from 1994 to 2022. Results suggest that the research field in the current domain is still in its early growth and expansion period in publications.



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Figure 1: Publishing trend in the topic

The results show that 504 authors and 54 peer-reviewed journals have published 201 of these identified research articles. Table 1 shows the top 20 most prominent authors based on the number of research articles published. As can be seen in this, Kamla Ali Al-Busaidi, Jukka Hallikas, James H. Love, Ritala P, and Stephen Roper seem to dominate the most prominent author list. The majority of these researchers have backgrounds in innovation, international business, and knowledge management.

Table 1: Most Prominent Authors

S. No.	Authors	Articles
1	Al-Busaidi KA	3
2	Hallikas J	3
3	Love JH	3
4	Ritala P	3
5	Roper S	3
6	Agarwal R	2
7	Al-Jabri H	2
8	Blomqvist K	2
9	Chen CI	2
10	Dezi L	2
11	Duysters G	2
12	Enkel E	2
13	Florin J	2
14	Giura SI	2
15	Gkypali A	2
16	Guan J	2
17	Hajek P	2
18	Hsiao YC	2
19	Hu Y	2
20	Hurmelinna-Laukkanen P	2

Table 2 shows the top 20 most relevant journals in which these research articles were published, in accordance with the Scopus database. As can be seen in this, Technological Forecasting and Social Change is the top most journal with 18 publications followed by the International Journal of Technology Management which has 13 publications. Journal of Technology Transfer (12 articles), European Journal of Innovation Management (11 articles), Journal of Knowledge Management (10 articles), Research Policy (10 articles), and Technovation (10 articles) are other most prominent journals.

Table 2: Most Relevant Journals

S. No.	Sources	Articles
1	Technological forecasting and social change	18
2	International journal of technology management	13
3	Journal of technology transfer	12

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4	European journal of innovation management	11
5	Journal of knowledge management	10
6	Research policy	10
7	Technovation	10
8	Journal of product innovation management	9
9	Knowledge management research and practice	7
10	Strategic management journal	7
11	IEEE transactions on engineering management	6
12	Management decision	5
13	Industrial marketing management	4
14	Industry and innovation	4
15	International journal of project management	4
16	Journal of business research	4
17	Management science	4
18	Production planning and control	4
19	Vine journal of information and knowledge management systems	4
20	International journal of information management	3

After carrying out a thorough literature review, following critical success factors were selected for the development of a hierarchical structural model: knowledge management, organizational learning, top management support, strategic alliances, technological knowledge, alliance experience, training and skill development, and absorptive capacity. Each of these identified factors is discussed along with its predicted influence on organizational innovation performance.

2.1 Knowledge Management

The significance of knowledge resources and their management has become critical for organizational innovation performance (Nonaka and Takeguchi, 1995). Knowledge management can be referred as the systematic management including creation, organization, diffusion and exploitation of relevant knowledge (Ruggles, 1998). Knowledge management requires several core competencies, including knowledge acquisition and storage, knowledge application, integration of new technologies, knowledge sharing, and creation (Storey and Kelly, 2002). Numerous studies have investigated the significance of strategic alliances and joint ventures as a tool for enhancing an organization's innovation performance through knowledge sharing and creation (Abbas et al., 2022; Agarwal and Selen, 2009). Strategic alliances encourage frequent and direct interactions between partners, facilitating organizational learning culture and knowledge sharing activities and a greater opportunity for knowledge creation, skill improvement, and learning (Al-Busaidi and Olfman, 2017). Scholars have also attempted to comprehend the relationship between organizational innovation activities and knowledge management, hypothesizing that knowledge transfer, knowledge sharing, and knowledge creation are significant factors for the success of organizational innovation (Al-Jabri and Al-Busaidi, 2020).

2.2 Organizational learning

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In the past few decades, works on organizational learning have made significant contributions to the extensive and varied literature on organizational innovation. The process by which organizations learn collectively through interaction with their environments has been described as organizational learning (Fiol and Lyles, 1985). Numerous academics assert that higher learning and knowledge management levels are necessary for high organizational innovation (García-Morales et al., 2012; Bowonder, 1998). Therefore, the level of critical ability, skill, and new and pertinent knowledge required increases as the degree of innovation of the products, services, or methods increases (Alegre and Chiva, 2008). Organizational learning advances this knowledge base, which is a necessary condition for organizational innovation (Senge, 1990). An organization that is committed to learning can increase its capacity for innovation and performance (McKee, 1992). Utilization of organizational learning is only possible when organizations are able to exchange knowledge and generate new knowledge based on the skill and expertise of others. Strategic alliances enable partner firms to gain new knowledge and skills from the shared experiences of partner firms, thereby enhancing the organization's innovative capabilities and knowledge base in order to sustain long-term competitive advantages.

2.3 Top management support

An organization's ability to innovate is significantly influenced by factors such as leadership style, management perceptions, and interactive vision (Jung et al., 2003; Scott and Bruce, 1994). Support from senior management can provide optimal learning environments, foster effective communication, and increase an organization's capacity for innovation (Kanter, 2009). The effects of top management cooperation and commitment have been studied in the literature on strategic management in a number of areas, such as organizational innovation, new product development, the creation of strategic alliances, alliance performance, and innovative organizational outcomes (Gumusluoglu, 2009; Ogbonna and Harris, 2000). Support from top management executives can offer the resources, rules, and incentive plans required for strengthening strategic alliances, which can improve organizational performance (Harborne and Johne, 2003). For the organization's growth and innovation, top management can support knowledge creation, sharing, organizational learning, and skill development (Lee, Shiue and Chen, 2016). Top management teams with a variety of specialties significantly impact executive decision-making, business models, relationships with local institutions, and R&D networks, which can help improve the flow of knowledge between organizations and the performance of organizational innovation (Livingston, 1969).

2.4 Strategic alliances

An organization cannot become productive and innovative if its employees work alone and in isolation. It must establish lateral, horizontal, upstream, and downstream links (Teece, 1992; Grunwald and Kieser, 2007; Hübel et al., 2022). According to Hess and Rothaermel (2011), an organization's innovation performance is determined by the interaction of two mechanisms. The first objective is recruiting and retaining talented employees, and the second is establishing strategic alliances. Strategic alliances facilitate the development of dynamic capabilities, such as integrating, constructing, and reorganizing current resources in response to evolving environmental conditions (Ettlie and Pavlou, 2006). New alliances increase the effectiveness of knowledge application and knowledge integration with industrial processes (Han et al., 2018). The innovation level of a strategic alliance is profoundly affected by the size of the partner company. Strategic alliances with large and innovative organizations foster innovation, whereas

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affiliations with small organizations that are not technologically advanced will hinder organizational innovation (Stuart, 2000). Researchers have also investigated the relationship between an organization's strategic partnerships and its patenting propensity (Shan et al., 1994; Baum et al., 2010), level of product innovativeness (Powell et al., 1996) and products under development (Deeds and Hill, 1996).

2.5 Technological Knowledge

One of the essential resources of an organization is its technical knowledge and expertise. The technological knowledge of an organization includes patents, technical expertise, and technical people (Morrison et al., 2008). The organization's technical skills and knowledge allow it to effectively utilise its technology and software and achieve optimum production (Moorman and Slotegraaf, 1999). Burgelman et al. (2004) defined technological knowledge as a comprehensive set of features owned by an organization that aids its technological innovation methods. In order to innovate creatively, organizations should prioritize investments in learning and technical knowledge development (Cohen and Levinthal, 1990). Diverse technological expertise will produce distinct innovation patterns (Breschi et al., 2000; Carmona-Lavado et al., 2021). Organizations must establish strategic partnerships and alliances with technological organizations in a knowledge-based economy in order to acquire technical know-how and expertise. Therefore, organizations can only grow and prevent imitation of their competitors by consistently improving and applying their technical knowledge to innovation and new business opportunities (Kogut and Zander, 1992; Bacon et al., 2019).

2.6 Alliance Experience

Alliance experience has been regarded as one of the essential knowledge management factors. Alliance experiences facilitate the acquisition of new knowledge about alliance management and its application (Kafouros et al., 2020). As organizations gain knowledge and experience in alliance management, they become more effective in leveraging alliances as learning opportunities and acquiring the skills necessary to obtain information from their partner firm (Hewitt-Dundas et al., 2019). Experience with alliances includes organizational learning and the development of knowledge that can be applied to the management of future partnerships and innovation performance (Burgelman and Hitt, 2007; Hu et al., 2022). Several scholars have hypothesized that firms with greater partnership experience are better able to learn and innovate (Taylor and Greve, 2006). Employees also gain additional experience and knowledge from the partner company, which significantly impacts future organizational innovations and performance. Hence, new knowledge, learning, experience, and skills result in organization-wide collaborative creativity.

2.7 Training and Skill Development

Innovation is required to maintain a long-term competitive advantage in the business market. If an organization desires its innovations to yield better results, it must increase its current level of knowledge and skill (Kim, 2002). In order to increase the organization's knowledge capability and put ideas into action, the top management team should be receptive to various initiatives for training programs, teamwork, good communication, and skill development (Antonioli and Della Torre, 2015; Dostie, 2017). When organizations invest in their internal training, employees gain and develop interpersonal skills that ultimately contribute to the organization's capacity for

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innovation (Martinez-Ros and Orfila-Sintes, 2012; Lopez-Cabrales et al., 2006). Organizational innovation and creativity require an internal and external training environment (Laursen, 2003; Teixeira et al., 2018). Numerous scholars have suggested that strategic alliances can be viewed as a mode of knowledge and skill acquisition for allied firms through joint training and development programs, internationalization of partner firms' skills, and interfirm knowledge transfer and sharing (Conn and Bitran, 2004). Training serves as a catalyst for knowledge transfer, acquisition of partner firm knowledge, skill development, effective communication experience, and organizational learning (James et al, 2007).

2.8 Absorptive capacity

According to the organizational learning theory, knowledge is the organization's primary source of innovation and competitive advantage. It argues that while the creation of new knowledge is important, its transformation into new products is the cornerstone of superior innovative performance (An et al., 2014; Al-Busaidi and Olfman, 2017). Absorptive capacity has been defined as the ability of an organization to learn from outside sources (Cohen and Levinthal, 1990). In addition, it has been described as an organization's strategic process and capacity to locate potentially beneficial new knowledge from outside sources, assimilate new knowledge through transformative learning, and exploit it to improve innovative capabilities and commercial outputs (Benhayoun et al., 2020). Organizations having high absorptive capacity are more likely to deeply understand newly available information and to use this information from other organizations to support their innovative efforts (Tsai, 2001; Fredrich et al., 2019). Numerous researchers have found that an organization's absorptive capacity substantially impacts its organizational learning, technical capability development, and R&D innovation activities (Daghfous, 2004). Scholars also suggest that strategic alliances can provide the organization with the necessary technical expertise, exposure, and experience to enhance its absorption capacity (Backmann et al., 2015).

2.9 Organizational Innovation Performance

Organizational innovation is critical for an organization's growth in a competitive and changing business environment (Cooper and Kleinschmidt, 1987). The performance of an organization's innovation is focused on managing product quality, reducing operating costs, maximizing activities for manufacturing goods and services, and designing an effective market development strategy. Organizational innovation necessitates task-specific skills and knowledge, experience, a wide range of technical skills, creativity, and cognitive capabilities in order to maximize an organization's performance (Demircioglu and Audretsch, 2017; Sengupta, 2014). Organizations should establish collaborative relationships with other businesses in order to cultivate external knowledge-learning and enhance their R&D capabilities, technological capacities, and innovative performance (Bodas Freitas and Fontana, 2018; Edmondson, 2016). Using a knowledge-based approach, strategic alliances can assist an organization in enhancing product quality, acquiring new knowledge, exchanging information, and fostering skill development (Barbaroux, 2012; Callagher et al., 2022; Guo and Zheng, 2021). Numerous scholars argue that organizational learning has a positive effect on the innovation performance of an organization (Bowonder, 1998). Support from the highest levels of management can assist in fostering a collaborative culture and joint learning activities within an organization, thereby promoting organizational learning and information flow and enhancing the innovation performance of the organization (Jung et al., 2003). Absorptive capacity is also regarded as the most significant

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factor impacting the effectiveness of organizational innovation performance (Benhayoun et al., 2020).

3 Research Methodology

The M-TISM technique (Sushil, 2017; Rajan et al., 2021; Hasan et al., 2019) is an extension of the ISM (Warfield, 1974) and TISM (Sushil, 2012) qualitative advanced modeling techniques. Its objective is to create a hierarchical structural model of critical success factors by analyzing relevant literature and establishing relationships among the identified factors. For this study, nine critical success factors were identified using the literature review. The m-TISM methodology (Rajan et al., 2021a; Singh and Dhir, 2021) was then applied to develop a hierarchical structural model of these critical success factors. Finally, expert opinions from industries that have successfully formed strategic alliances (both service and product) were obtained to validate the model. Each expert was interviewed for 30 to 40 minutes. The developed model was validated using a five-point Likert scale questionnaire with closed-ended questions. The m-TISM technique involves several steps, including a comprehensive literature review, identification of critical success factors, developing a hierarchical structural model, and validation through expert opinions and questionnaires. The key steps of the M-TISM method are:

Step 1: Identification of factors- This stage facilitates comprehension of the available literature within the current research domain. On the basis of a review of the relevant literature, we have identified nine critical factors that are associated to well-defined research problems. Table 3 lists the identified critical success factors.

Table 3: Identified Factors

Code	Critical Success Factors	Supporting Literature
C1	Knowledge management	Alegre et al, 2013; Darroch, 2005; Grant, 1996; Ruggles, 1998
C2	Organizational learning	Aragón-Correa et al., 2007; Fiol and Lyles, 1985; Stata, 1989
C3	Top management support	Gumusluoglu, 2009; Harborne and John, 2003; Tushman and Nadler, 1986.
C4	Strategic alliances	Ettlie and Pavlou, 2006; Hess and Rothaermel, 2011;
C5	Technological knowledge	Burgelman et al., 2004; Song et al., 2005
C6	Alliance Experience	Daveri and Parisi, 2015; Kelly and Amburgey, 1991; Newbert, 2007
C7	Training and skill development	Martínez-Ros and Orfila-Sintes, 2012; Lopez-Cabrales et al., 2006
C8	Absorptive capacity	Cohen and Levinthal, 1990; Tsai, 2001; Daghfous, 2004
C9	Organizational innovation performance	Cooper and Kleinschmidt, 1987; Sterlacchini, 1999

Step 2: Contextual relationship- In this stage, a contextual relationship is formed between the identified factors. A contextual link indicates that factor A facilitates the accomplishment of factor B. For example, A leads to B.

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Step 3: Interpretation relationship of the identified factors: In this stage, we explain the relationship between all identified pairs of factors (see Table 11). It is important to specify how the identified factors interact with one another.

Step 4: Pairwise comparison of the identified factors: In this stage, a digraph-based pairwise comparison of identified factors are constructed (see Figure 2). In addition, we perform a simultaneous transitivity check on a successive comparison digraph using the transitivity rule. If A is related with B and B is related with C, then A also is related with C, according to the transitivity rule. This check will continue until the transitivity rule is applied to all factors.

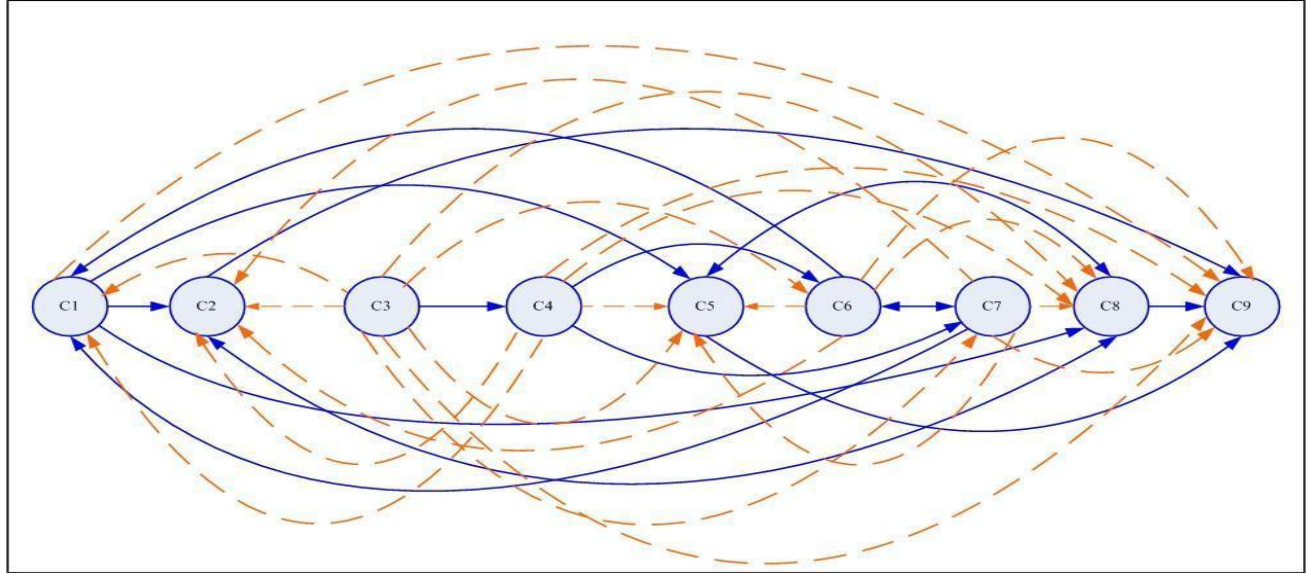


Figure 2: Successive digraph

Step 5: Development of Reachability matrix: In this stage, we build a reachability matrix in which all direct and transitive relationships are represented as “1” and “1*” respectively (see Table 4).

Table 4: Reachability Matrix

Factors	C1	C2	C3	C4	C5	C6	C7	C8	C9
C1	1	1	0	0	1	0	0	1	1*
C2	0	1	0	0	0	0	0	0	1
C3	1*	1*	1	1	1*	1*	1*	1*	1*
C4	1*	1*	0	1	1*	1	1	1*	1*
C5	0	0	0	0	1	0	0	0	1
C6	1	1*	0	0	1*	1	1	1*	1*
C7	1	1*	0	0	1*	1	1	1*	1*
C8	0	0	0	0	0	0	0	1	1
C9	0	0	0	0	0	0	0	0	1

Step 6: Level partition of identified factors-

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In this stage, the final reachability matrix is utilized to determine the levels of the identified factors. First, the reachability and antecedent sets are identified during this step. The top of the hierarchy is inhabited by factors whose reachability set and intersection set are identical. In the level partition, it is considered that factors that have previously occupied the hierarchy do not factor into further calculations (see Table 5).

Table 5: Partition of Reachability Matrix

Iteration 1				
Factors	Reachability Set	Antecedent Set	Intersection Set	Level
C1	1,2,5,8,9	1,3,4,6,7	1	
C2	2,9	1,2,3,4,6,7	2	
C3	1,2,3,4,5,6,7,8,9	3	3	
C4	1,2,4,5,6,8,9	3,4	4	
C5	5,9	1,2,3,4,5,6,7	5	
C6	1,2,5,6,7,8,9	3,4,6,7	6,7	
C7	1,2,5,6,7,8,9	3,4,6,7	6,7	
C8	8,9	1,3,4,6,7,8	8	
C9	9	1,2,3,4,5,6,7,8,9	9	I
Iteration 2				
Factors	Reachability Set	Antecedent Set	Intersection Set	Level
C1	1,2,5,8	1,3,4,6,7	1	
C2	2	1,2,3,4,6,7	2	II
C3	1,2,3,4,5,6,7,8	3	3	
C4	1,2,4,5,6,8	3,4	4	
C5	5	1,2,3,4,5,6,7	5	II
C6	1,2,5,6,7,8	3,4,6,7	6,7	
C7	1,2,5,6,7,8	3,4,6,7	6,7	
C8	8	1,3,4,6,7,8	8	II
Iteration 3				
Factors	Reachability Set	Antecedent Set	Intersection Set	Level
C1	1	1,3,4,6,7	1	III
C3	1,3,4,6,7	3	3	
C4	1,4,6	3,4	4	
C6	1,6,7	3,4,6,7	6,7	
C7	1,6,7	3,4,6,7	6,7	
Iteration 4				
Factors	Reachability Set	Antecedent Set	Intersection Set	Level
C3	3,4,6,7	3	3	
C4	4,6	3,4	4	
C6	6,7	3,4,6,7	6,7	IV
C7	6,7	3,4,6,7	6,7	IV
Iteration 5				
Factors	Reachability Set	Antecedent Set	Intersection Set	Level

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C3	3,4	3	3	
C4	4	3,4	4	V
Iteration 6				
Factors	Reachability Set	Antecedent Set	Intersection Set	Level
C3	3	3	3	VI

Table 6: Factors and Their Level to build TISM Model

Factor Code	Factor Name	Level
C1	Knowledge Management	III
C2	Organizational learning	II
C3	Top Management Support	VI
C4	Strategic Alliances	V
C5	Technological Knowledge	II
C6	Alliance Experience	IV
C7	Training and Skill Development	IV
C8	Absorptive capacity	II
C9	Organizational innovation performance	I

Step 7: Development of m-TISM model: The m-TISM model is developed by utilising the relationships given in the reachability matrix and the level of the factors. This hierarchical structural model includes both direct and indirect relationships, which aids in determining the relationship between the factors. In the final m-TISM layered model, only significant transitive linkages are included.

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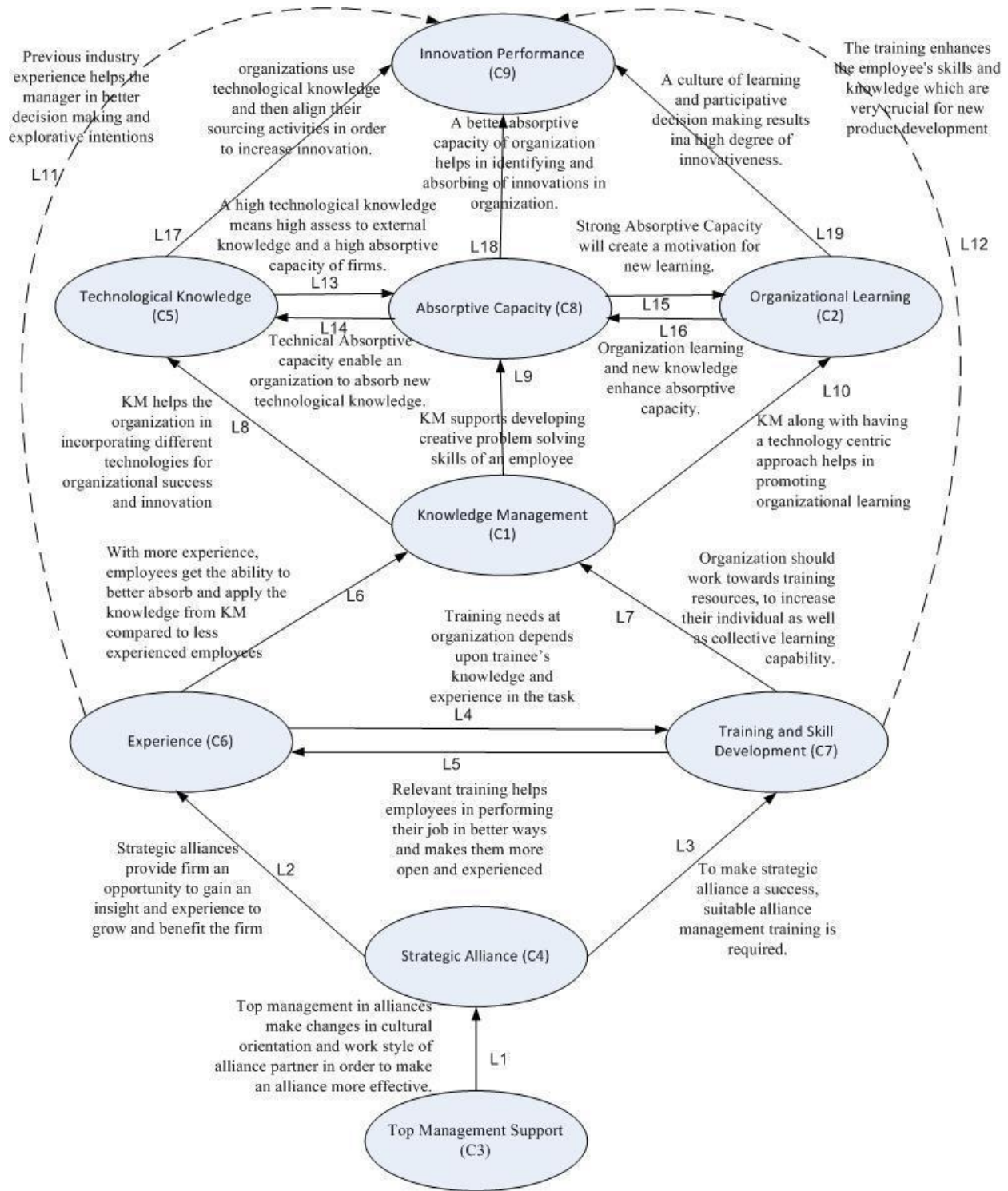


Figure 3: Modified TISM Model

4. Validation of M-TISM digraph through expert opinion in successfully strategically alliance industries (Service and Product):

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The developed m-TISM model was validated using a panel of industrial experts from service as well as manufacturing organizations. In a developing country like India, service and product-based industries are continuously competing for organizational innovation to survive in the long run. Organizations carry out strategic alliances to gain mutual benefit and learn from each other in order to improve their organizational innovation performance. A group discussion was held to gather the perspectives of industry experts on the developed hierarchical structural model and the interrelationship between identified factors. The group discussion method was utilized to obtain the majority view of industry experts. This strategy was favored since it enabled us to participate in the group discussion effectively and in greater depth, with no ambiguity or uncertainty. Multiple service and product-based businesses have formed strategic alliances with other industries. One week prior to the direct visit, the M-TISM model was emailed to the experts as a separate document so they could study it in depth. To explain the concept of the m-TISM model and its research foundation, experts in New Delhi, India, were consulted directly.

The chosen industrial experts came from various organizations and had between 5 and 23 years of experience. Following a discussion with a variety of industrial experts, 14 experts were selected: seven from the service industry and seven from the product industry. The group of industrial experts had diverse and non-uniform backgrounds. The particulars and profiles of the chosen experts are listed in Tables 5 and 6. The experts were asked if the list of critical organizational innovation performance factors was appropriate and comprehensive. All of the experts agreed that the identified critical factors were appropriate and detailed information. Then, the experts were asked whether the six levels of hierarchy and interrelationships among the m-TISM model's factors are logical. All of the experts agreed that the levels of the hierarchy were highly logical. All industrial experts agreed that the m-TISM model could be implemented to improve organizational innovation performance.

Table 7: Expert Profile in Service organizations

For Service Organizations			
Expert No	Experience (Years)	Company	Current Position in Organization
1	9	Accenture	Senior Manager
2	10	Accenture	Senior Executive
3	10	Accenture	General Manager
4	7	HCL	Strategy and Operation Manager
5	8	HCL	Senior Manager
6	6	Fiserv India Pvt. Ltd.	Senior Executive
7	8	Fiserv India Pvt. Ltd.	General Manager

Table 8: Expert Profile for product-based organizations

Manufacturing/Product based Organizations			
Expert No	Experience (Years)	Company	Current Position in Organization

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1	10	Qualcomm India Pvt Ltd	Senior Executive
2	8	Qualcomm India Pvt Ltd	Operation General Manager
3	7	Mentor Graphics	Senior Executive
4	23	Mentor Graphics	Senior Manager
5	10	Panasonic India Pvt Ltd	Strategy and Operation Manager
6	12	Panasonic India Pvt Ltd	Senior Executive
7	10	Panasonic India Pvt Ltd	General Manager

Following that, experts weighed the interrelationship of factors. On a 5-point Likert scale, industrial experts were asked to rank the links in the developed model (Lubatkin et al., 2006). On a 5-point scale, 1 indicated strongly disagree, and 5 indicated strongly agree. The expert opinion average was used. The developed m-TISM model accepted links with an average score of three or higher. Model validation was computed by taking the average of all the links. Finally, the experts agreed on the m-TISM model and all of the links. The average score for service organizations is 4.737, while it is 4.616 for manufacturing organizations. As a result, the model is widely accepted by service and manufacturing organizations alike.

Table 9: Validation of digraph in Service Organizations

Link	Interpretation	Ex1	Ex2	Ex3	Ex4	Ex5	Ex6	Ex7	Average score for each link	Average score for the model
C3-C4	Top Management Support directly impact strategic alliance	5	5	5	5	4	5	5	4.857 Accept the link	4.737 Accept the model
C4-C6	Strategic Alliance directly impact Alliance Experience	5	4	5	5	3	5	5	4.571 Accept the link	
C4-C7	Strategic Alliance directly impact training and skill development	5	5	5	5	4	4	5	4.714 Accept the link	
C6-C7	Alliance Experience directly impact training and skill development.	5	5	5	5	4	5	5	4.857 Accept the link	
C7-C6	Training and skill development directly	5	4	5	5	4	5	4	4.571 Accept the link	

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	impact Alliance Experience.									
C6-C1	Alliance Experience directly impact Knowledge Management	5	5	5	5	4	5	5	4.857 Accept the link	
C7-C1	Training and skill development directly impact Knowledge Management	5	5	5	5	4	5	5	4.857 Accept the link	
C1-C5	Knowledge Management directly impact Technological Knowledge	5	5	5	5	4	5	5	4.857 Accept the link	
C1-C8	Knowledge Management directly impact Absorptive Capacity.	5	5	5	5	4	5	4	4.714 Accept the link	
C1-C2	Knowledge Management directly impact Organizational Learning	5	5	5	5	4	5	4	4.714 Accept the link	
C6-C9	Alliance Experience indirectly impact Innovation Performance	5	5	5	5	4	5	4	4.714 Accept the link	
C7-C9	Training and skill development indirectly impact Innovation Performance	5	4	5	5	4	4	5	4.571 Accept the link	
C5-C8	Technological knowledge directly impact Absorptive Capacity.	5	5	5	5	4	5	5	4.857 Accept the link	
C8-C5	Absorptive Capacity directly impact Technological Knowledge	5	5	5	5	5	5	4	4.857 Accept the link	
C8-C2	Absorptive Capacity directly impact Organizational Learning.	5	4	5	5	4	4	5	4.571 Accept the link	
C2-C8	Organizational learning directly	5	5	5	5	4	5	5	4.857 Accept the link	

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	impact Absorptive Capacity.									
C5-C9	Technological knowledge directly impact Innovation Performance	5	4	5	5	4	5	5	4.714 Accept the link	
C8-C9	Absorptive Capacity directly impact Innovation Performance	5	3	5	5	5	4	5	4.571 Accept the link	
C2-C9	Organizational learning directly impact Innovation Performance	5	4	5	5	5	4	5	4.714 Accept the link	

Table 10: Validation of Digraph in product-based organizations

Link	Interpretation	Ex 1	Ex2	Ex 3	Ex 4	Ex5	Ex 6	Ex 7	Average score for each link	Average score for the model
C3-C4	Top Management Support directly impact strategic alliance	5	4	4	5	5	5	5	4.714 Accept the link	4.616 Accept the model
C4-C6	Strategic Alliance directly impact Alliance Experience	5	4	4	5	5	4	5	4.571 Accept the link	
C4-C7	Strategic Alliance directly impact training and skill development.	5	5	5	1	5	4	5	4.285 Accept the link	
C6-C7	Alliance Experience directly impact training and skill development	5	4	5	5	5	4	5	4.714 Accept the link	
C7-C6	Training and skill development directly impact Alliance Experience	5	5	4	5	5	3	5	4.571 Accept the link	
C6-C1	Alliance Experience directly impact Knowledge Management	5	5	5	5	5	5	5	5 Accept the link	
C7-C1	Training and skill development	5	3	5	5	5	3	5	4.428 Accept the link	

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	directly impact Knowledge Management									
C1-C5	Knowledge Management directly impact Technological Knowledge	5	3	5	5	5	3	5	4.428 Accept the link	
C1-C8	Knowledge Management directly impact Absorptive Capacity.	5	5	4	5	5	3	5	4.571 Accept the link	
C1-C2	Knowledge Management directly impact Organizational Learning	5	5	5	5	5	4	5	4.857 Accept the link	
C6-C9	Alliance Experience indirectly impact Innovation Performance	5	4	4	5	5	4	5	4.571 Accept the link	
C7-C9	Training and skill development indirectly impact Innovation Performance	5	3	5	5	5	3	5	4.428 Accept the link	
C5-C8	Technological knowledge directly impact Absorptive Capacity.	5	5	5	5	5	4	5	4.857 Accept the link	
C8-C5	Absorptive Capacity directly impact Technological Knowledge	5	5	4	5	5	3	5	4.571 Accept the link	
C8-C2	Absorptive Capacity.directly impact Organizational Learning	5	5	5	5	5	3	5	4.714 Accept the link	
C2-C8	Organizational learning directly impact Absorptive Capacity.	5	5	5	5	5	3	5	4.714 Accept the link	

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C5-C9	Technological knowledge directly impact Innovation Performance	5	5	5	5	5	3	5	4.714 Accept the link	
C8-C9	Absorptive Capacity directly impact Innovation Performance	5	4	4	5	5	3	5	4.428 Accept the link	
C2-C9	Organizational learning directly impact Innovation Performance	5	5	4	5	5	3	5	4.571 Accept the link	

5. Results and Discussion

In a competitive and volatile business domain, both product innovation and process innovation are important for the growth of an organization. This study has been conducted to identify and examine the critical factors which in turn have a direct or transitive (indirect) influence on the innovation performance within the organizations. The m-TISM method has been effectively applied to examine major influential inter-relationships among the identified critical success factors and to develop a hierarchical structure of those factors. 9 critical success factors have been selected using an extensive literature review. Based on the identified factors, this study developed a hierarchical m-TISM model to facilitate industry practitioners in improving innovation performance within the organizations. The developed hierarchical structural model also describes the relationship between identified factors and organizational innovation performance. From the developed m-TISM model, it can be seen that there are significant, influential relationships exist among the identified factors. A total of 19 links (direct and transitive) exist in the model. The model has been categorized into 6 levels.

Level 6: Top management support (C3)

Top management support (C3) lies at the lower level (level 6), which makes it the most influential factor in the developed m-TISM model. Hence, it can be considered as the supporting pillar of the developed model and demands significant attention from the practitioners. The model shows that C3 has a direct influence on strategic alliances.

Level 5: Strategic alliances (C4)

A strategic alliance is placed at level 5, and it has a direct effect on the prior alliance experience of employee as well as training and skill development.

Level 4: Prior alliance experience (C6) and training and skill development (C7)

Prior alliance experience and training and skill development are placed at the same level (level 4). At this level, both factors impact each other, and they have a significant direct influence on knowledge management (C1), which is placed at level 3. The model also shows that C6 and C7 have an indirect link (transitive) with the factor of organizational innovation performance.

Level 3: Knowledge management (C1)

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Knowledge management is the only factor at level 3. This factor has a direct influence on technical knowledge, absorptive capacity, and organizational learning.

Level 2: Technical knowledge (C5), Absorptive capacity (C8), and organizational learning (C2)

As shown in the model, technical knowledge, absorptive capacity, and organizational learning lie at level 2 and directly impact the Innovation performance (C9).

Level 1: Organizational Innovation Performance (C9)

Organizational Innovation Performance occupies the first level in the model. This factor gets impacted by all the other factors.

6. Implications

6.1 Theoretical Implications

This paper contributes to the organizational innovation literature by offering a structural model which shows the hierarchy and inter-relationships among identified factors. Very few studies have been done in the past literature investigating the combined effects of these identified critical success factors in the context of organizational innovation performance. The first contribution of this study is the development of a hierarchical structural model of factors that shows a comprehensive and systematic view of the organizational innovation phenomenon through strategic alliance and knowledge management. In line with the knowledge-based view and an organizational learning perspective, the developed model helps to understand how partner firms can acquire new valuable knowledge, technical knowledge, and skills from strategic alliances and partnerships in order to improve organizational innovation performance. The second contribution of this study is the validation of the developed model using expert opinion from both the service industry and the manufacturing industry. Future researchers can use the m-TISM methodology and study results to further innovation and knowledge management research.

6.2 Implications for Practice

From the standpoint of practitioners, the study presents a hierarchical layered model of innovation performance management critical factors. A primary managerial implication is the selection of strategic alliances and knowledge management for improved organizational innovation results. According to the developed model, top management can support knowledge creation and sharing practices that fuel the desired levels of organizational innovation performance through strategic alliances. According to this study, strategic alliances are superior at fostering knowledge creation, knowledge sharing, skill development, and organizational learning. As a result, when forming strategic alliances, organizations should aim to promote knowledge management practices, facilitate skill development, develop technical knowledge, and improve organizational learning in order to increase organizational innovation.

7. Conclusion and Future research scope

There has been very little research on the interdependence of critical success factors influencing organizational innovation performance in the context of strategic alliance and knowledge management. This study adds to previous research by establishing a hierarchical relationship between the critical factors, with a focus on strategic alliance and knowledge management.

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Following an extensive literature review, nine critical success factors were identified, and M-TISM was used to develop the model. In the developed model, top management support is provided at the lowest level and is directly linked to a strategic alliance. As a result, top management support is the most important factor, directly or indirectly influencing all other factors. It is very important in increasing the organization's innovation performance through effective leadership skills, decision-making, and developing a learning culture within the organization. The strategic alliance is a key factor that influences innovation performance by influencing other key factors at the fifth level. Strategic alliances and business partnerships are used by organizations to gain external knowledge, experience, and technology from their partners. Both experience and training are available at level 3 and have a direct impact on organizational innovation performance. Managers and skilled employees with prior experience can be valuable resources in fostering organizational innovation. Similarly, training improves employees' skills and technical knowledge, both of which are critical for new product development and innovation. Level 2 brings technological knowledge, skill development, and organizational learning, all of which directly impact organizational innovation performance. As a result, the study's findings indicate that, in general, external knowledge and technical expertise can be easily acquired and learned through strategic alliances.

Though this paper adds to the strategic alliance literature, it also has limitations associated with it. This study utilized only nine critical success factors to develop the structural model. It is possible to do a more in-depth literature review to increase the number of factors that can enhance the impact of the study. Second, expert opinions were used to validate the model outputs; however, samples were from the Indian context and were of a relatively small size. In this way, validation of the developed model may be conducted utilizing a larger number of experts from a variety of geographical contexts. In addition, empirical validation and examination using case studies can also be carried out by future researchers.

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APPENDIX

Table 11: Interpretation of final digraph links

Factors Code	Pair wise comparison	Interpretation	Supporting literature
C3-C4	Top management directly impact strategic alliance	Leadership skills, their behavior and work style determine the success or failure of strategic alliance. A successful strategic alliance will bring innovation to the firm.	Judge and Ryman, 2001; Schweitzer, 2014
C4-C6	Strategic Alliance directly impact alliance experience	Knowledge and learning achieved as a result of alliance impact organization knowledge creation which in turn positively influence the innovative performance.	Inkpen, 1998; Heyes and Stuart, 1996
C4-C7	Strategic Alliance directly impact training and skill development.	To make strategic alliance a success, suitable alliance management training is required.	Bitran et al, 2002; Conn, S and Bitran, I 2004.
C6-C7	Alliance Experience directly impact training and skill development.	Training is a function of interaction between trainee's experience and career motivation. For highly motivated trainee, experience is positively linked to training behaviors.	Wolf et al., 1995; Roberson et al., 2001; Sargent et al, 2009
C7-C6	Training and skill development directly impact Alliance experience.	Relevant training helps employees in performing their job in better ways and makes them more open and experienced.	Beck, 1988; Varghese, 1988
C6-C1	Alliance Experience directly impact Knowledge Management	A more experienced employees has the ability to better absorb and apply the knowledge from KM as compared to a less experienced employees,	Disterer, 2002; Ko and Dennis, 2011
C7-C1	Training and skill development directly impact Knowledge Management	Training employees on various dimensions like team building, multi skills, and need based training, socialization and formalized orientation is very useful to increase employees' cognitive and social abilities.	Johannessen and Olsen, 2003; Ubeda-Garcia, 2012; Hwang, 2003
C1-C5	Knowledge Management directly impact Technological Knowledge	Knowledge Management helps the organization in understanding and incorporating different technologies for organization success and innovation	Hitt et al., 2000 ; Lee et al., 2013
C1-C8	Knowledge Management directly impact Absorptive Capacity.	Knowledge Management significantly impacts the opportunity recognition skill via managerial skill. It also supports creative problem solving skills of an employee	Maneewan et al., 2017; Anholon et al., 2016;
C1-C2	Knowledge Management directly impact Organizational Learning	Knowledge management and a technology centric approach helps in creating organizational learning.	Hitt et al., 2000; Ho, 2008
C6-C9	Alliance Experience indirectly impact Innovation Performance	Previous industry experience helps the manager in better decision making and explorative intentions.	Osiyevskyy and Dewald , 2015
C7-C9	Training and skill development indirectly impact Innovation Performance	The training enhances the employee's skills and knowledge which are very important for new product development.	Sung and Choi, 2014; Antonioli and Della Torre, 2015

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C5-C8	Technological knowledge directly impact Absorptive Capacity	Technological knowledge helps in shaping skill and performance of employee.	Kell et al, 2014; Campbell, 1990;
C8-C5	Absorptive Capacity directly impact Technological Knowledge	Behavioral and interpersonal skills are very crucial for technological knowledge acquisition.	Peter et al, 1994; Lamb et al., 1995
C8-C2	Absorptive Capacity directly impact Organizational Learning.	Skill development acts as a foundation for organization learning to take place. Lack of skills negatively impact project performance as well as organizational technology learning.	Cohen and Levinthal, 1990; James et al, 2007.
C2-C8	Organizational learning directly impact Absorptive Capacity.	In today's dynamic business environment, "learning organization" concepts are very crucial. In order to work in such changing environment, a set of core skills are needed which can only be developed with the learning organization.	Devi, 2019; Hill et al., 1998.
C5-C9	Technological knowledge directly impact Innovation Performance	Firms align their sourcing activities as per available technological knowledge in order to increase innovation.	Miller et al, 2007, Howell and Boies, 2004.
C8-C9	Absorptive Capacity directly impact Innovation Performance	A specific set of skill, knowledge and abilities which is relevant with the firm will bring out innovation in the firm	Lopez-Cabrales et al., 2006; Doran and Ryan, 2014
C2-C9	Organizational learning directly impact Innovation Performance	An organization which focuses on learning and participative decision making shows a high degree of innovativeness.	Garcia-Morales et al., 2012; Alegre and Chiva, 2008