# Critical factors for knowledge management implementation: a TISM validation

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**Abstract:** This paper aims to understand the reasonable role of knowledge management (KM) in creating capability for the sectors of society to establish awareness and proper decision-making to untangle the complexities of current world challenges. The paper attempts to identify various factors of KM through a literature review, which are further analysed through 'total interpretive structural modelling' (TISM) and 'matriced impacts crosses multiplication applique and classement' (MICMAC) to implement the KM strategy in an adequate manner. A total of ten factors have been identified. The TISM

methodology represents the hierarchical structure of the factors and demonstrates the relationship among the factors by giving logical explanation about the driving/dependence power of each factor. A TISM-based hierarchical framework has been demonstrated, followed by the determination of the components' dependency and driving power using MICMAC analysis. This enables practitioners, academics and policymakers to strategise appropriately.

**Keywords:** knowledge management; information and communication technology; ICT, innovation; entrepreneurship.

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## 1 Introduction

The world economy is going through a phase of economic slowdown as the gross domestic product (GDP) growth is continuously declining. Changing global scenarios have significant implications for economists and global supply chains, international corporations, government policies and the environment (Elliott et al. 2020). However, the maturity of the current ecosystem indicates opportunities to explore new ideas and

proposals that emphasise the relevance of entrepreneurship in economies. Knowledge management (KM) processes and structures in organisations help improve performance and competitive standing by facilitating innovations (Bindra et al., 2020; Edvardsson, 2006). They utilise both existing and new knowledge to solve challenges and create novel solutions by continuously adapting to the changing scenarios (McAdam, 2000).

Knowledge is accumulated by human activities, processes, social interactions, experiences and cognitive interpretation of information (Paschek et al., 2018; Holsapple, 2005). However, KM is generally neglected in its implementation (Winkler and Mandl, 2007). It indicates an organisation's intentional and methodical approach to knowledge use and application (Mandl and Reinmann-Rothmeier, 1999). Acquiring knowledge via learning is an intrinsic and never-ending process that results in the daily accumulation of tacit and implicit knowledge (Rajan and Dhir, 2021). The practical application of KM strategies results in a significant increase in the likelihood of innovation. Therefore, successful implementation of KM is essential to grab new skills and behaviours to facilitate smooth rollout of the economic activity crisis (Muqadas et al., 2017).

By doing extensive research in the literature and by applying 'total interpretive structural modelling' (TISM), this study seeks to identify the essential success criteria for the effective implementation of KM (Bindra et al., 2022). The study also seeks to undertake a matriced impacts crosses multiplication applique and classement (MICMAC) analysis to determine the degree of dependence and driving power of the critical success factors identified. Based on conformance from the literature (Sushil, 2017; Singh et al., 2018), as well as the responses of 20 experts in the field of strategy and management in India, an interpretive matrix method with iterations was applied to identify the relationship between the factors (Bindra et al., 2019; Rajesh, 2017). To examine the hierarchical links among a set of factors for a given concept, TISM is frequently employed in paired comparisons to assess the relationships between the factors. The use of this approach can assist in the conversion of an abstract or unstructured mental model into a well-articulated model that can be used as a foundation for conceptualisation and model construction.

## 2 Literature review

Executing KM is applying information from previous experiences selectively to current and future decision-making to increase an organisation's effectiveness. KM processes enable the collection, storage, retrieval and reuse of collected knowledge (Jennex, 2005). Additionally, the entity's systematic and intentional efforts to grow, nurture and use knowledge in value-adding ways enable the goal to be accomplished. Implementing KM encompasses the processes of production, application and exploitation and the processes of sharing and disseminating knowledge and encapsulating and sourcing knowledge (Inkpen and Dikur, 1998). The concept of knowledge speeds up the production, collection and market pull. The classical way of creating value does not suffice as the only source of competitive advantage. Still, it encompasses various transformational and transactional activities wherein the modern systems are increasingly based on knowledge, innovation, performance improvement and competing effectively. Hence, the modern KM system takes advantage of the wealth of experience, talent and skills to bring transformational and transactional change in an organisation (Basadur and Gelade, 2006).

It will institutionalise trust, facilitate knowledge transfer and create a development domain. Superior performance is driven by KM (Bosua and Venkitachalam, 2013), and it is a critical resource for the survival and development of organisations (Teece et al., 1997). It shapes effective decision-making, leveraging accurate knowledge for better opportunities (Elmorshidy, 2018). Shared knowledge helps organisations reduce redundant work, avoid reinventing the wheel, reduce training intervals and retain intellectual capital as the employee turnover increases (Bontis et al., 1999; Grant, 1996). As evidenced by their need to effectively implement KM, competitively conscious organisations benefit from sharing knowledge (Epetimehin and Ekundayo, 2011). It enforces a strong linkage among digitalisation, communication and connectivity and articulates new skills and capabilities through creativity and innovation in learners, based on information and knowledge. Improved and adequate knowledge is developed by training and research analysis integrated into information technology (Costa and Monteiro, 2016). Organisations also ensure continuous learning to yield creative outcomes. Thus, KM as a strategic management tool needs to be implemented in a certain way, so that the factors recognised through the literature review interact to pull amelioration in organisations.

## *2.1 Empowerment, control and continuous learning*

To address the difficulties of today's dynamic environment, organisations must strike a balance among effectiveness, efficiency and innovation, while also participating in interdisciplinary, culturally competent and self-reflective practice (Hopkins and Hyde, 2002). An accurate KM platform develops empowerment capacity, organisational learning and knowledge enhancement (Abualoush et al., 2018). Organisations can provide opportunities to update the knowledge, and the KM platform shall control and monitor the knowledge sources, facilitating the development of workers' ability, skills and mental competence continuously. It will acquire competitive advantages and innovation (Nonaka, 1994). Learnings in the form of novel knowledge, empowerment, and awareness increases the confidence of participants to invest in producing good-quality products and services or enhance entrepreneurial ideas (Huber, 1991). Controlling the knowledge makes the spontaneity, transparency, adaptor and fast learning skills get developed (Mundy, 2010). It minimises the chances of exploiting knowledge in the process that might create threatening situations by imposing limitations (Henri, 2006). Inverted knowledge in the control system ensures commitment to objectives and supports exploration of opportunities and solutions. Another intention of empowering and controlling is to increase the connectivity with other organisations, workers, citizens and other people, as the acquired knowledge is embedded in the organisational storage or codified. Only organisations have the copyright to transfer, converse or distribute knowledge to the internal and external environment.

## *2.2 Research and development*

Research generates assumptions, possibilities and predictions about the knowledge variable (Anupama, 2018). It also identifies the problems and solutions that can be verified and offers explanations by furnishing proof that knowledge of the research background is enough to extend existing knowledge (Binoy, 2019). It examines problems to untangle them to produce powerful tools (Mourougan and Sethuraman, 2017). Based

on research and development (R&D) results, technology can work to improve performance with little effort. When knowledge is analysed via research, it separates superfluous knowledge. It speeds innovation by relying on rapid changes and minimising the process cycle by establishing efficient long-term objectives through creating anathemas, among other things (Baumol, 1993).

### *2.3 Strategic structure*

Database design, document and workflow management are all strategy components (Hansen et al., 1999). They help to use information technology in communicating knowledge, transfer and exchange via a network, such as decision forms, or generate new, specific solutions through integration in the research process (Michailova and Husted, 2003). The strategic purpose of knowledge gain should be tightly related to the objective (Zack, 1999). Strategic structure adds value to the organisation (Venkatraman, 1989). Thus, the strategic direction should go through research, hypothesis and even technology to create a well-functioning KM system (Bolisani et al., 2017). In this way, the effectiveness of a strategy is influenced by the environment, motivation and vision of an organisation (Shujahat et al., 2017). Operating strategic structure in a dynamic environment may lead to fast and efficient innovative development (Davenport et al., 1998). The fundamental, integrated and current planning elements include supportive infrastructure, the readiness of knowledge adaptivity, electronic connectivity, easy access and dissemination of learning culture (Ford and Chan, 2003). Strategies reorient the emphasis on resource knowledge and establish knowledge as a resource capable of generating interchangeable competitive advantages (Kogut and Zander, 1992).

### *2.4 Motive, vision and training*

Mission concentrates and specifies the priorities and objectives, while motivation, vision and training offer long-term goals that define an organisation's future (Shee and Abratt, 1989). Vision is a pattern of value creation that serves as the foundation for a specific visionary plan for acquiring knowledge (Bowen, 2015). Vision facilitates strategic decision-making by clarifying objectives and allocating scarce resources (Larwood et al., 1995). It helps manage and set a hierarchy of priorities that an organisation faces in daily and long-term operations (Pearce, 1982) and establishes team efforts towards common goals for coping with transitions or turbulent environments (Oswald et al., 1994). Motive, vision and training prepare a mindset to perform assigned missions (Fitzgerald, 1992). Training could improve efficiency by facilitating teamwork and accumulating knowledge (Becker, 1962). It prepares an organisation to handle the assigned work and upcoming changes by integrating knowledge (Zwick, 2006).

### *2.5 Implementation for development in society*

KM becomes a conduit for entrepreneurs for adopting incoming knowledge (Cassiman and Veugelers, 2002). With great openness and speed of connectivity and exchange in the new digital economy, entrepreneurs can generate long-term survival, productivity and innovation, reviving the economic condition (Audretsch and Keilbach, 2007). Knowledge spillover in the industry can challenge the firms and enterprises to manage knowledge,

investment and collaboration to perform rigidly in the market ecosystem (Van Beers and Zand, 2014). Moreover, acquiring knowledge at educational institutions demonstrates the efficiency and efficacy of curriculum aids, creation of knowledge repositories and transformation of information or data into knowledge storage systems (Fauzi et al., 2019; Thorn, 2001). Higher education with the KM system in libraries and electronic collection of educational materials, networks for email communication and management information integrate the value of knowledge in the mind of students (Rowley, 2000). Students turn out to be great personalities who can administrate, be responsive and create decision-makers with leadership vision and strategy (Oakley, 2002). Such learners are more likely to become entrepreneurs and are encouraged to implement KM processing in the institutions (Piccoli et al., 2000).

### *2.6 Information and communication technology*

Information and communication technology (ICT) in organisations contributes to improving the knowledge learning process. ICT should develop and implement cyber services to increase the interaction among the knowledge sources and share elements to increase information storage (Soto-Acosta and Cegarra-Navarro, 2016). Information technology develops understanding and awareness about knowledge transition in an organisation (Hendriks, 2001). It extracts basic information and data from the knowledge sources and constructs hypotheses to test and separate adequate knowledge beneficial for the organisation (Jackson, 2001). ICT addresses new knowledge and creates a platform for KM (Sharma et al., 2020b). It has now developed social computing tools and models, research agendas and strategies that are more adaptive and responsive (Pan and Scarborough, 1998). Organisations can easily organise, store and collect knowledge that can be used for insights and values (Allee, 1997). Because of the excellent integration of technological processes and procedures, employees may efficiently accumulate a great deal of information (Temel et al., 2013). For the generation of KM, ICT is a critical instrument linked with the acceptance and dissemination of technology to generate innovation and motivations to deliver advantages, low-cost investment and raise the learning curve (Goodhue and Thompson, 1995).

### *2.7 Creating teamwork*

Teamwork refers to good coordination and bonding among the employees in an organisation (Soni, 2020; Zaccaro et al., 2001). More realistic expectations, effective motivators, economic cooperation, necessary tasks and regular learning and feedback are found in a team with a clearly defined strategic framework (Whaley and Gillis, 2018). Mutual cooperation between the team members and decision-makers is critical, as colleagues must bear equal responsibility for providing meaningful knowledge (Jones and Barrett, 2016). Teamwork guarantees that we remain focused on a single direction rather than diverging on multiple paths. Team members mastering different fields build trust, communication, interpersonal skills and flexibility (Papakitsos and Argyriou, 2017). Different perspectives of different members help open different dimensions of the assigned work, leading to detecting threats and risks of the KM system before implementation, which can be solved through research agendas and analysis of models (Nadikattu, 2020).

### *2.8 Infrastructure and capital*

KM requires successful implementation of infrastructure and capital in an organisation. Human resource refers to a pool of employee talent, experience, skills and talents that generate economic value because they are one-of-a-kind, rare, unique competitive advantage and valuable to the organisation. Humans play a significant role in innovation by executing ideas (Özbağ et al., 2013). Infrastructure like ICT, connectivity, collaboration and systematic storing allows the transfer of knowledge and information experience to produce something innovative. Firms continuously revitalise their knowledge and combine it to create new knowledge. Hence, the assets must be flexible to realign the existing knowledge and resources to explore more innovations.

### *2.9 Communication and connectivity*

Connectivity creates an excellent knowledge transfer among organisations (Thorell, 1986). The organisations communicate and connect with each other to enhance their knowledge, which could foster innovation (Al-Busaidi and Olfman, 2017). Connectivity between organisations and recipients of information via communication includes semantic issues of terms and taxonomy of connectivity (Allen and Cohen, 1969). It complements certain types of knowledge transfer; organisations' relations must be trustworthy with standard bases such as culture, values and profession. The flow of knowledge might include tacit and explicit knowledge (Marouf, 2016). The information obtained shall be integrated with resources to build an internal innovation capability (Durst and Zieba, 2019). Connectivity and communication are the external transfer of information, assimilation, acquisition and exploitation (Cohen and Levinthal, 1990). Connecting with outside entities and introducing new information work as 'gatekeepers', as organisations' sufficient professional skills and knowledge help avoid misunderstandings and connect organisations by dissolving the barriers between them.

### *2.10 KM system*

KM has evolved as a strategy for organisations to accommodate emerging requirements (Gold et al., 2001). Increased efficiency and effectiveness are achieved by an organisation through improved performance and competitive advantage, as well as by learning from past mistakes, integration and continual development in order to extend knowledge (Chinowsky and Carrillo, 2007). Effective information distribution promotes mobility and progress in knowledge-based activities. KM is a set of intellectual abilities in an organisation, in which both humans and technology strategically generate valuable knowledge to survive and revive the economy (Smith, 2001). The organisation may use this method to determine its strengths and weaknesses and develop the necessary strategies and processes to enhance performance (Durst et al., 2019).

Research into sensing the environment, creating perceptions, generating meaning for interpretation and prior experiences contributes to knowledge generation. The process turns raw data into knowledge that can promote innovation. The KM system can be implemented in different sectors of societies, such as industries, small and medium-sized enterprises (SMEs), education, etc. Integration of KM in the educational sector can bring robust, innovative ideas, as the young learners possess continuous learning capability

inbuilt in them and make quick decisions, use creativity and skills in a surprisingly unexpected manner that would bring economic revolution and subtract the negative implications of a pandemic from the society.

## 3 Research methodology

### *3.1 Total interpretive structural modelling*

The KM system highlights the need for integrating valuable knowledge in organisations to foster innovative entrepreneurship in various sections of society (Sharma et al., 2020a). An in-depth literature review of the subject domain has identified the factors responsible for implementing adequate KM (Dhir et al., 2020). The paper uses TISM to build a guided framework for the complex structure based on the known interrelationships between the various factors to encapsulate mental models in a structured form for drawing inference (Rajan and Dhir, 2020b). This model is based on the conceptual analysis of the interpretative structure model (ISM), and it is used as a tool for verifying the hierarchical structures of factors generated from various statistical treatments (Sushil, 2012). The TISM-based framework is intended to identify, among other things, the interrelationships between the factors to form their hierarchy (Warfield, 1974). Based on the conformance from the literature (Sushil, 2017), as well as the responses of 20 experts in the field of strategy and management in India, an interpretive matrix method with iterations was applied to identify the relationship between the factors (Rajesh, 2017). For this, experts, both from the industry and academia, were nominated carefully to integrate consequences from the viewpoint of practical and academic researchers, as suggested by Yadav and Sagar (2021). The responses were obtained through semi-structured interviews. In the initial phase of TISM, all the factors were codified as follows:

F1 R&D

F2 empowerment, control and continuous learning

F3 strategic structure

F4 motive, vision and training

F5 implementation for development in society

F6 ICT

F7 creating teamwork

F8 infrastructure and capital

F9 communication and connectivity

F10 KM system.

A paired comparison of the criteria obtained from expert opinions in accordance with the literature was conducted (Table 1). This matrix was checked using the transitivity rule and then changed until complete transitivity was determined (Dhir et al., 2020). A binary matrix helps analyse the factors placed in rows and columns, where self-cross

interactions are codified by '0' and '1'. '1' is given when the factors get affected by any other factor, and '0' is given when the factors do not get affected.

Decoding the responses of expert views into a binary matrix is commonly referred to as reachability matrix (Dhir et al., 2021). First, level partitions are settled in the position of reachability set (RS) and antecedent set (AS). The RS includes all '1s' in a row, and the AS includes all '1s' in a column. Then, a cross section between RS and AS recognises commonality, which shall be placed in a hierarchical structure according to its levels.

**Table 1** Binary matrix of intersectional relationship among the factors

| *Codes* | *F1* | *F2* | *F3* | *F4* | *F5* | *F6* | *F7* | *F8* | *F9* | *F10* |
|---|---|---|---|---|---|---|---|---|---|---|
| F1 | 1 | 1* | 0 | 0 | 1 | 1 | 0 | 1 | 1 | 1 |
| F2 | 0 | 1 | 0 | 0 | 1 | 0 | 0 | 1 | 1 | 0 |
| F3 | 1 | 1 | 1 | 0 | 1 | 1 | 1 | 1 | 1 | 1 |
| F4 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 |
| F5 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 |
| F6 | 1 | 1 | 0 | 0 | 1 | 1 | 0 | 1 | 1 | 1 |
| F7 | 1 | 1 | 1 | 0 | 1 | 1 | 1 | 1 | 1 | 1 |
| F8 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 1 | 0 | 0 |
| F9 | 0 | 1 | 0 | 0 | 1 | 1* | 0 | 1 | 1 | 0 |
| F10 | 0 | 1 | 0 | 0 | 1 | 0 | 0 | 1 | 1 | 1 |

**Table 2** Level partition examining the hierarchy among the factors

| | | *Iteration- 1* | | |
|---|---|---|---|---|
| *Codes* | *Reachability set* | *Antecedent set* | *Intersection* | *Levels* |
| F1 | 1, 2, 5, 6, 7, 9, 10, 11 | 1, 3, 4, 6, 7, 8 | 1, 6, 7 | |
| F2 | 2, 5, 9, 10 | 1, 2, 3, 4, 6, 7, 8, 10, 11 | 2, 10 | |
| F3 | 1, 2, 3, 5, 6, 7, 8, 9, 10, 11 | 3, 4, 8 | 3, 8 | |
| F4 | 1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11 | 4 | 4 | |
| F5 | 5 | 1, 2, 3, 4, 6, 7, 8, 9, 10, 11 | 5 | 1 |
| F6 | 1, 2, 5, 6, 7, 9, 10, 11 | 1, 3, 4, 6, 7, 8 | 1, 6, 7 | |
| F7 | 1, 2, 5, 6, 7, 9, 10, 11 | 1, 3, 4, 6, 7, 8 | 1, 6, 7 | |
| F8 | 1, 2, 3, 5, 6, 7, 8, 9, 10, 11 | 3, 4, 8 | 3, 8 | |
| F9 | 5, 9 | 1, 2, 3, 4, 6, 7, 8, 9, 10, 11 | 9 | |
| F10 | 2, 5, 9, 10 | 1, 2, 3, 4, 6, 7, 8, 10, 11 | 2, 10 | |
| F11 | 2, 5, 9, 10 | 1, 3, 4, 6, 7, 8, 11 | 11 | |

**Table 2** Level partition examining the hierarchy among the factors (continued)

| *Iteration-2* | | | | |
|---|---|---|---|---|
| *Codes* | *Reachability set* | *Antecedent set* | *Intersection* | *Levels* |
| F1 | 1, 2, 6, 7, 9, 10, 11 | 1, 3, 4, 6, 7, 8 | 1, 6, 7 | |
| F2 | 2, 9, 10 | 1, 2, 3, 4, 6, 7, 8, 10, 11 | 2, 10 | |
| F3 | 1, 2, 3, 6, 7, 8, 9, 10, 11 | 3, 4, 8 | 3, 8 | |
| F4 | 1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11 | 4 | 4 | |
| F6 | 1, 2, 6, 7, 9, 10, 11 | 1, 3, 4, 6, 7, 8 | 1, 6, 7 | |
| F7 | 1, 2, 6, 7, 9, 10, 11 | 1, 3, 4, 6, 7, 8 | 1, 6, 7 | |
| F8 | 1, 2, 3, 6, 7, 8, 9, 10, 11 | 3, 4, 8 | 3,8 | |
| F9 | 9 | 1, 2, 3, 4, 6, 7, 8, 9, 10, 11 | 9 | 2 |
| F10 | 2, 9, 10 | 1, 2, 3, 4, 6, 7, 8, 10, 11 | 2,10 | |
| F11 | 2, 9, 10 | 1, 3, 4, 6, 7, 8, 11 | 11 | |
| *Iteration-3* | | | | |
| F1 | 1, 2, 6, 7, 10, 11 | 1, 3, 4, 6, 7, 8 | 1, 6, 7 | |
| F2 | 2, 10 | 1, 2, 3, 4, 6, 7, 8, 10, 11 | 2, 10 | 3 |
| F3 | 1, 2, 3, 6, 7, 8, 10, 11 | 3, 4, 8 | 3, 8 | |
| F4 | 1, 2, 3, 4, 6, 7, 8, 10, 11 | 4 | 4 | |
| F6 | 1, 2, 6, 7, 10, 11 | 1, 3, 4, 6, 7, 8 | 1, 6, 7 | |
| F7 | 1, 2, 6, 7, 10, 11 | 1, 3, 4, 6, 7, 8 | 1, 6, 7 | |
| F8 | 1, 2, 3, 6, 7, 8, 10, 11 | 3, 4, 8 | 3, 8 | |
| F10 | 2, 10 | 1, 2, 3, 4, 6, 7, 8, 10, 11 | 2, 10 | 3 |
| F11 | 2, 10, 11 | 1, 3, 4, 6, 7, 8 ,11 | 11 | |
| *Iteration-4* | | | | |
| F1 | 1, 6, 7, 11 | 1, 3, 4, 6, 7, 8 | 1, 6, 7 | |
| F3 | 1, 3, 6, 7, 8, 11 | 3, 4, 8 | 3, 8 | |
| F4 | 1, 3, 4, 6, 7, 8, 11 | 4 | 4 | |
| F6 | 1, 6, 7, 11 | 1, 3, 4, 6, 7, 8 | 1, 6, 7 | |
| F7 | 1, 6, 7, 11 | 1, 3, 4, 6, 7, 8 | 1, 6, 7 | |
| F8 | 1, 3, 6, 7, 8, 11 | 3, 4, 8 | 3, 8 | |
| F11 | 11 | 1, 3, 4, 6, 7, 8, 11 | 11 | 4 |
| *Iteration-5* | | | | |
| F1 | 1, 6, 7 | 1, 3, 4, 6, 7, 8 | 1, 6, 7 | 5 |
| F3 | 1, 3, 6, 7, 8 | 3, 4, 8 | 3, 8 | |
| F4 | 1, 3, 4, 6, 7, 8 | 4 | 4 | |
| F6 | 1, 6, 7 | 1, 3, 4, 6, 7, 8 | 1, 6, 7 | 5 |
| F7 | 1, 6, 7 | 1, 3, 4, 6, 7, 8 | 1, 6, 7 | 5 |
| F8 | 1, 3, 6, 7, 8 | 3, 4, 8 | 3, 8 | |

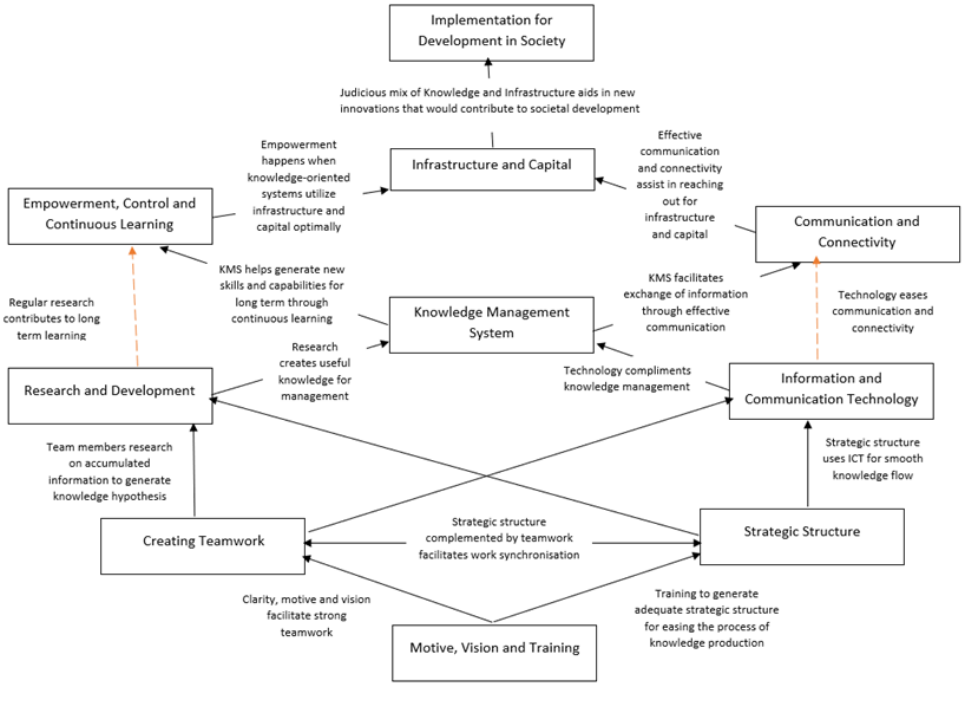
**Table 2** Level partition examining the hierarchy among the factors (continued)

| *Iteration-6* | | | | |
|---|---|---|---|---|
| *Codes* | *Reachability set* | *Antecedent set* | *Intersection* | *Levels* |
| F3 | 3, 8 | 3, 4, 8 | 3, 8 | 6 |
| F4 | 3, 4, 8 | 4 | 4 | |
| F8 | 3, 8 | 3, 4, 8 | 3, 8 | 6 |
| *Iteration-7* | | | | |
| F4 | 4 | 4 | 4 | 7 |

Level partitioning is carried out like the ISM method, wherein all elements are supported with levels. As shown in Table 2, multiple iterations aid in defining various elements in the reachability matrix at different degrees of intensity. Multiple iterations are used to determine various elements involved in the TISM-based framework (Sushil, 2012).

As depicted in the first iteration in Table 2, factor 5 (F5), namely, 'implementation for development in society', lies at the highest level in the hierarchical structure as the intersection between the reachability set and the antecedent set remains the same with factor 5. This signifies that the factor will settle at the top of the TISM structure. Therefore, in the subsequent steps, factor 5 will be removed from the level partition and the rest of the factors will intersect again until the next-level hierarchy is identified.

**Figure 1** Diagrammatic representation of KM showing the hierarchy of the elements (see online version for colours)



In the second iteration, factor 9 (F9), that is, 'infrastructure and capital', attains the second level of the hierarchy, followed by 'empowerment, control and continuous learning' and 'communication and connectivity' in the third iteration. 'KM system' fell at the third level, as depicted in the fourth iteration, followed by 'R&D, ICT, and accumulation and analysis of research model' settling at the fifth level in the hierarchy. Factors, namely, 'strategic structure' and 'creating teamwork' are positioned at the sixth level, whereas 'motive, vision and training' occupies the seventh and the bottom-most level.

The final phase aims at the development of validated hierarchical model. The diagrammatic depiction of these factors is done by the levels determined based on expert views. The dotted lines show transitive links between the factors, while the straight lines represent direct interactions. With the help of TISM, a bottom-up hierarchical model was constructed that allows for the quick and easy identification of both driving and dependent factors (Sharma et al., 2020a). The results demonstrate that 'implementation for development in society' has the highest power dependency and the lowest driving strength (Figure 1).

### *3.2 MICMAC analysis*

The advantages of TISM are numerous compared to other multi-attribute approaches, but still, TISM fails to analyse the strength and bond among the factors. This limitation of TISM is addressed by MICMAC, which classifies the relationship among the factors to clarify the concept of driving and dependence power. It also recognises solid and weak factors, as all the relationships among the factors are not always in equilibrium and they change with the requirement of the environment.

**Table 3** Binary matrix calculating the driving power and dependence power

| *Codes* | *F1* | *F2* | *F3* | *F4* | *F5* | *F6* | *F7* | *F8* | *F9* | *F10* | *F11* | *SUM* |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| F1 | 1 | 1 | 0 | 0 | 1 | 1 | 1 | 0 | 1 | 1 | 1 | 8 |
| F2 | 0 | 1 | 0 | 0 | 1 | 0 | 0 | 0 | 1 | 1 | 0 | 4 |
| F3 | 1 | 1 | 1 | 0 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 10 |
| F4 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 11 |
| F5 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 1 |
| F6 | 1 | 1 | 0 | 0 | 1 | 1 | 1 | 0 | 1 | 1 | 1 | 8 |
| F7 | 1 | 1 | 0 | 0 | 1 | 1 | 1 | 0 | 1 | 1 | 1 | 8 |
| F8 | 1 | 1 | 1 | 0 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 10 |
| F9 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 1 | 0 | 0 | 2 |
| F10 | 0 | 1 | 0 | 0 | 1 | 0 | 0 | 0 | 1 | 1 | 0 | 4 |
| F11 | 0 | 1 | 0 | 0 | 1 | 0 | 0 | 0 | 1 | 1 | 1 | 5 |
| | 6 | 9 | 3 | 1 | 11 | 6 | 6 | 3 | 10 | 9 | 7 | |

Dhir and Dhir (2020) define MICMAC as 'matriced impacts crosses multiplication applique and classement', which is based on the notion of multiplication characteristics of matrices (Janssen et al., 2019). One of the primary objectives of employing this technique was to examine and categorise factors of interest in terms of driving power and dependence power, wherein all the factors were classified into four specified clusters

(Sindhu et al., 2016). As described in MICMAC method, the dependency power of a binary matrix is determined by adding up the sums of its columns (ref. Table 3). In contrast, the driving power is determined by adding up the sums of its rows (Table 4).

**Table 4** Quadrants and their characteristics representing MICMAC analysis

| *Clusters* | *Description* | *Characteristics* | *Driving power* | *Dependence power* | *Factors* |
|---|---|---|---|---|---|
| Cluster 1 | Autonomous factors | These factors are relatively disconnected from the system and may not be strong. | Weak | Weak | |
| Cluster 2 | Dependent factors | These factors are mostly dependent on others and are themselves weak. | Weak | Strong | F11; F2; F10; F9; F5 |
| Cluster 3 | Linkage factors | These factors are extremely unstable, so any action on them would affect other factors and also have influence on them. | Strong | Strong | F1; F6; F7 |
| Cluster 4 | Driving factors | Factors with very strong driving power are called key factors which influence other enabling variables. | Strong | Weak | F4; F3; F8 |

Based on MICMAC, the relationship among the factors is examined and elaborated using driving and dependence power (Rajan et al., 2021). Following is the representation of relative importance and interdependence on the factors.

- *First quadrant* – Autonomous factors make up the first quadrant of the diagram. These factors have a weak driving force and a weak dependency and are primarily isolated from the system as a whole. There are no such factors in this cluster, indicating that no factor can be regarded isolated from the rest of the system. So, management must pay attention to all the recognised factors. Hence, all factors are relevant in creating the KM system to contribute to economic revival.
- *Second quadrant* – The dependence quadrant has five factors; they have low driving and high dependence power. Since these variables are typically dependent on other variables, any action performed on other variables will affect these. 'KM system' (F11) is independent with solid driving power (5) and weak dependence power (7). This comes at the fourth level in the TISM (Figure 1). Similarly, 'empowerment, control and continuous learning' (F2) and 'communication and connectivity' (F10) have strong driving power (4) and weak dependence power (9) and come at the third level. 'Infrastructure and capital' (F9) has weak driving power (2) and strong dependence power (10). Likewise, 'implementation for development in society' (F5) has strong driving power (1) and strong dependence power (11), and it comes at the top of the hierarchical structure.
- *Third quadrant* – The third quadrant contains the 'linkage variables' (relay variables) with a high driving force and dependency. The high instability of linking factors is one of their most distinctive properties. As a result, every action taken on them will affect other factors and contain feedback. Therefore, managers must exercise

extreme caution when dealing with these factors. For example, in the research presented here, the linkage quadrant has 'R&D' (F1), 'ICT' (F6) and 'accumulation and analysis of research model' (F7), which have high driving power (8) and high dependence power (6).

- *Fourth quadrant* – The 'independent factors' (impact factors) in the fourth quadrant have high driving power, but low dependency power. Due to the strong driving force of independent factors, policymakers should pay more attention to them since they can affect other enabling factors. It has been determined that factors with a high driving force, referred to as main factors, are classified as independent or linked factors. The independent quadrant contains 'strategic structure' (F3) and 'creating teamwork' (F8), which have strong driving power (10) and weak dependence power (3); similarly, 'motive, vision and training' (F4) is at the bottom of the hierarchy and has strong driving power (11) and weak dependence power (1).

## 4 Discussion and implications

An organisation in need of a KM system must have a clear vision and motive regarding the objective, so that the organisation can provide adequate training to build strong team support with suitable strategies (Brown and Duguid, 1998). Accumulation of knowledge becomes easier with teamwork, strategic structure and ICT, which is a well-trained process to accumulate information. The basic information requires filtration and analysis to extract necessary knowledge that can benefit the whole organisation. This is done through research model integration (Rajan and Dhir, 2020a). The filtered knowledge requires administrative backing to share, disseminate and apply the knowledge to create innovative entrepreneurship. Knowledge-oriented firms empower their employees by giving them opportunities to become more skilful and prompt decision-makers and more capable of innovating (Edvardsson and Durst, 2013). Knowledge is the primary source of innovation, and it requires adequate and flexible infrastructure and capital to foster entrepreneurship and contribute to society to a certain degree. The industrial sector needs a revolution to add value to a declining GDP. It requires SMEs and new entrepreneurial ideas (Durst and Ferenhof, 2014). Passionate new entrepreneurs require skills and capabilities to enhance technology and support innovation (Durst et al., 2020). Hence, there is a need to put in a KM system to preserve the knowledge and monitor it, as it helps in the development of capabilities, talents, skills thereby increasing the chances of creating innovators, entrepreneurs and self-motivated and problem-solving agents (Temel and Durst, 2018).

## 5 Conclusions

In the current threatening situation, communicating information and maintaining the knowledge appropriately is productive in organisational performance and economic growth. It boosts the confidence of organisations with skills to manage the knowledge understandably. It enables rapid transformation into resources, employee skills and mindset. The efficiency increases as KM is dependent on ICT and technology. KM has become a value creation tool with possibilities to improve the industrial sector affected

by transition. Implementation of the KM system in various sectors of society can bring innovative enterprises that may also influence other fields like agriculture, medicine, education and transportation (Sharma et al., 2020c). Knowledge at the level of globalisation can facilitate the expansion of trade with innovative technologies, liabilities and policies. Also, for such expansion of knowledge, the internet has fostered the flow of knowledge. Value creation through knowledge is crucial in identifying and designing creative, innovative models to improve productivity and increase the GDP, while decreasing the implications of the pandemic and its impact on the economy that has resulted in poverty, inequality and inflation.

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