# Classification of Inter-Organizational Knowledge Mechanisms and their Effects on Networking Capability: A Multi-Layer Decision Making Approach

Nima Garousi Mokhtarzadeh, Hannan Amoozad Mahdiraji, Ismail Jafarpanah, Vahid Jafari-Sadeghi, and Stefano Bresciani



**Original citation & hyperlink:**
Mokhtarzadeh, N.G., Mahdiraji, H.A., Jafarpanah, I., Jafari-Sadeghi, V. and Bresciani, S., 2021. Classification of inter-organizational knowledge mechanisms and their effects on networking capability: a multi-layer decision making approach. *Journal of Knowledge Management* (In Press)
https://dx.doi.org/10.1108/JKM-07-2020-0579

DOI 10.1108/JKM-07-2020-0579
ISSN 1367-3270

Publisher: Emerald

# Classification of Inter-Organizational Knowledge Mechanisms and their Effects on Networking Capability: A Multi-Layer Decision Making Approach

**Purpose.** The role of inter-organizational knowledge mechanisms (IOKMs) in learning networks is increasing so that the competition of business networks in providing innovations is highly dependent on the effective selection and application of these mechanisms. This study argues that recognizing the classification of IOKMs and understanding their impact on networking capability (NC) makes the selection of mechanisms more effective.

**Design.** With a systematic review of literature, a comprehensive list of IOKMs, their main characteristics, and NCs have been extracted. The authors have used a focus group for data gathering and a hybrid multi-layer decision-making approach for data analysis. Finally, the impact of IOKMs on NC was determined.

**Findings**. By implementing a multi-layer decision-making approach, four categories of IOKMs including person-to-person, co-creation, team-oriented, and informational are illustrated and their effects of NC are determined. Therefore, the findings of this research provide latecomer firms (LCFs) managers with a clear framework for selecting IOKMs.

**Originality**. The literature review shows that the number of knowledge mechanisms, especially their inter-organizational types, is increasing. It has made it difficult for LCFs managers to select effective and efficient mechanisms. Most of these mechanisms are listed, and few studies have classified them. Besides, research shows that fewer studies have investigated how IOKMs relate to NC. Furthermore, most studies on IOKMs have been conducted in the context of leading firms and LCFs have been neglected.

**Keywords.** Inter-Organizational Knowledge Mechanisms; Networking Capability; Multi-Layer Decision Making; Classification.

**Article classification.** Research paper

## 1. Introduction

The necessity of inter-organizational relationships is growing increasingly. The considerable complexity of products has made it less likely for firms to have all the resources needed to achieve their goals (Chesbrough, 2006) and it has led companies to seek a collaborative advantage (Lavie, 2006; Ardito et al., 2019a). Due to increasing environmental uncertainty, these inter-organizational relationships have become much more networked (Mokhtarzadeh *et al*., 2018; 2020). A network is a complex and interconnected set of individuals, groups, and organizations, and networking is the ability to develop and deploy a network to meet goals (Tidd and Bessant, 2013).

Inter-organizational collaborations can be categorized from different perspectives, like the direction and subject of cooperation (Tjemkes et al., 2017). Meanwhile, firm knowledge deficiencies in the pursuit of their strategic goals and the high risk of knowledge development have led to a sharp increase in the development networks (Hitt *et al*., 2000; ; Ardito et al., 2019b). Sufficient inter-organizational knowledge sharing in learning networks requires careful consideration of specific issues. Some of them include partners' knowledge needs, knowledge sharing purpose, the characteristics of the partner's knowledge base, features of knowledge sharing mechanism, the status of knowledge sharing enablers and barriers, and the expected learning outcomes. In the meantime, the role of inter-organizational knowledge mechanisms (IOKMs) is so prominent because these mechanisms simultaneously contribute to knowledge transfer, sharing, application, and integration (Lindgren and Widen, 2018). According to Chai *et al*. (2003), IOKMs is a set of methods, procedures, and processes involved in knowledge sharing and learning at inter-organizational level. Research shows that the competitiveness of business networks in delivering innovation and success of knowledge sharing heavily depends on the selection and effective implementation of IOKMs (Slaughter and Kirsch, 2006; Natalicchio et al., 2017), Therefore knowledge sharing is enhanced through IOKMs (De Meyer, 1991). Although several studies have focused on the significance of applying IOKMs in learning networks (Mokhtarzadeh and Faghei, 2019), the effect of IOKMs on enhancing networking capability (NC) for learning purpose remains unknown.

Latecomer firms (LCFs) have recently received considerable attention from the academic and practitioner worlds. These firms trade in developing countries and intend to enter global markets by upgrading their innovation capability. Studies show that the number of LCFs that have been able to enter the Fortune 500 has increased significantly (Zhang, 2014); the share of LCFs in acquiring the foreign direct investment is increasing (UNCTAD, 2014); and their role in global value chains is becoming more significant (OECD, 2013). One of the most important drivers that upgrade LCFs is the proper use of NCs (Cho and Lee, 2003) and IOKMs (Bell and Figueroa, 2012; Hansen and Lema, 2019). These mechanisms help the accumulation of know-how and technological learning of LCFs; Therefore, they can improve their innovation capability level. Despite the fundamental role of IOKMs in the upgrading of LCFs, most studies related to IOKMs have been conducted in the context of leading international firms. Consequently, LCFs considerably have been neglected in the IOKMs literature.

This study addresses three significant research gaps. First, despite the severe impact of IOKMs on firm performance, few efforts have been made to analyze their inefficiencies and select suitable mechanisms (Slaughter and Kirsch, 2006; Jasimuddin *et al*., 2014). In this regard,

Jasimuddin et al. (2009) introduce "the mechanism's appropriateness," referring to the usefulness of a certain mechanism in knowledge transfer. A literature review reveals that IOKMs are increasingly proliferating, and this has made it difficult for managers to select them (Van Waveren *et al*., 2017) since various mechanisms have different effects on knowledge sharing (Wickramasinghe and Widyaratne, 2012). Most of these mechanisms have been cataloged, and a few studies categorized them (Prevot, 2005). However, these studies categorized IOKMs only with limited characteristics (e.g., Dyer and Nobeoka, 2000; Chai *et al*., 2003; Sako, 2004; Distanont *et al*., 2012). The classification of IOKMs based on a small number of variables has led to over-simplification and the non-applicability of these frameworks for practitioners and has made it difficult to evaluate the performance implications of the IOKMs for academics (Van Waveren *et al*., 2017). Therefore, it is necessary to classify IOKMs by considering more characteristics.

Second, the experience of successful firms shows that they have improved the performance of their learning networks by applying IOKMs correctly (Dyer and Nobeoka, 2000), but few studies have addressed when, why, and how to employ IOKMs (Chai, 2003; Chai and Yap, 2004). This study argues that a significant reason that clarifies how IOKMs is applied is their impact on NC. In other words, understanding the fact that which mechanism enhances which dimension of NC can be a guideline for selecting them. Therefore, it can be claimed that since various IOKMs have different effectiveness in networking, their proper selection has a severe impact on network management (Harrington *et al*., 2019). Few studies have investigated how knowledge mechanisms relate to NC (Knoppen *et al*., 2011). For example, only some studies have suggested that if a focal firm intends to enhance its partner selection capability, it is better to utilize the supplier association mechanism (Dyer and Nobeoka, 2000). If it plans to improve its coordination and conflict resolution capabilities, it can apply a concurrent engineering mechanism (Nobeoka and Baba, 2001). Therefore, it is necessary to examine how IOKMs support NC to clarify how these mechanisms are applied to learning networks. In this context, this study seeks to answer the theoretical dilemma of which IOKMs should be used to enhance each dimension of NC.

Third, as Harrington *et al*. (2019) emphasized, the success of any "knowledge initiative" is strongly dependent on the analysis of the sharing context and the preconditions for its success. Since most studies on IOKMs have been conducted in the context of leading firms (Iddy, 2020), there is a research gap in investigating IOKMs in the context of LCFs, which are forced to increase their technology and market resources through networking capability for joining international markets.

The contribution of this study to the knowledge management and inter-organizational collaboration literature is discussable from three perspectives. First, since previous research has categorized knowledge mechanisms based on only a small number of characteristics, their reliability may be limited. This study improves the classification quality by providing a comprehensive list of mechanisms, their characteristics, and a more suitable method. Second, in the sense that the use of IOKMs is essential for LCFs success (Iddy, 2020) and can protect them from the Not-Invented-Here syndrome (Natalicchio et al., 2017), our framework will help LCFs to select the most appropriate mechanism at the appropriate time. The innovative idea of this study is that the influence of different classes of IOKMs on NCs is a guideline for selecting the appropriate mechanism. This idea helps LCFs to determine which combination of IOKMs

is proper for which of sharing processes (Balle et al., 2019). Third, the present study focuses on the context of LCFs, providing specific implications in comparison with leading firms.

This study seeks to answer the central question of what types of knowledge mechanisms support the networking capability in the LCFs context. Therefore, a comprehensive framework is presented for the classification of IOKMs. The objectives of this study are identifying IOKMs, introducing their features, providing the taxonomy of these mechanisms based on multiple characteristics, and prioritizing the mechanisms based on how they support NC. Accordingly, this study is organized as follows. In section 2, after the problem statement, the literature review is provided. In section 3, the research methodology is outlined. Then, in section 4, data analysis and results are presented, and the research framework is developed. Finally, in section 5, the conclusions and lessons learned from the study are described.

## 2. Fundamental concepts and literature review

### *2.1 Describing the IOKMs*

Knowledge mechanisms are divided into two broad categories, including intra and inter-organizational mechanisms (Balle et al., 2019). Thus, they are relevant at four levels of analysis: individual, group, organizational, and inter-organizational (Snider and Nissen, 2003). Consistent with Easterby-Smith *et al*. (2008), our study is focused on the fourth level. According to Chai *et al*. (2003), IOKMs is a set of methods, procedures, and processes involved in knowledge sharing and learning at the inter-organizational level. The selection of appropriate IOKMs affects the learning rate in business networks (Easterby-Smith *et al*., 2008; Van Waveren *et al*., 2017). Studies have introduced several IOKMs for learning, discussed as follows.

Physical relocation is a mechanism by which human resource dispatch, transfer, relocation, and rotation for learning purpose. Network-level job rotation (Dyer and Nobeoka, 2000) and manufacturing site visits (Rebentisch and Ferretti, 1995) are two instances in this case. This mechanism facilitates knowledge transfer between the sender and receiver due to face-to-face interaction and direct contact with information sources. These managerial levers enable tacit and critical knowledge transfer to foster interpersonal communication and mutual trust.

Concurrent product definition is another mechanism that examines the relationships between designing components for manufacturing and analyzing the overall functionality of the product in the early phases of its development by network partners (Nobeoka and Baba, 2001). In this regard, applying a co-definition mechanism requires multiple interactions between partners, considering product module specifications in the partner selection tool (Belkadi *et al*., 2018). Nobeoka and Baba (2001) argue that the successful implementation of concurrent engineering depends on creating a common language and sharing the same knowledge by the different teams involved in the project. They have also introduced the design-build team mechanism in which a hierarchy of teams is formed to manage the co-development project of a new product. One of the main functions of design teams is to resolve task-related conflicts through negotiation that is dependent on social and communication skills (Kirenan *et al*., 2019).

Dyer and Nobeoka (2000) introduce four other IOKMs: supplier association, consulting / problem-solving teams, voluntary learning teams, and employee's inter-firm assignment. In the supplier association, information is exchanged between the focal firm and supplier to develop

and enhance collaborative skills through (Wang *et al*., 2019). In consulting / problem-solving teams, the focal firm provides direct on-site assistance to its suppliers and provides a needed context for knowledge transfer between suppliers. These teams store and disseminate transferable implicit knowledge across the network (McIver *et al*., 2019). Moreover, voluntary learning teams are a mechanism whose primary purpose is to share knowledge among suppliers.

Moreover, Chai and Yap (2004) introduce forums, boundary-spanners, and manufacturing audits. Forums are periodic sessions where engineers and managers share experiences in their areas of expertise and responsibilities. Forums are usually formed at most meetings and conferences; however, today, "online discussion forums," is significantly expanding (Liu *et al*., 2018). Boundary-spanners are "human agents who translate and frame information from one community to another to promote coordination" (Hawkins and Rezazadeh, 2012). Boundary-spanners with complete control over the context where knowledge is applied can assist in tacit knowledge transfer, especially when contextual information is not available. In manufacturing audits, the focal firm evaluates how the network members are produced, and while providing their strengths and weaknesses, it takes corrective actions to reach higher levels.

Another mechanism is certifying suppliers (Knoppen *et al*., 2011), in which the suppliers must demonstrate that they follow necessary process measures and have a commitment to improving their processes. This increases the suppliers' reputation and makes it easier for them to attract project proposals. Spraggon and Bodolica (2012) proposed informal meetings and dynamic virtual processes. These mechanisms are unstructured and highly dynamic, and as a result, the spontaneous and voluntary activities of those present on the network are formed. Dynamic virtual processes are interactive communication channels enabling the virtual exchange of information. These kinds of mechanisms are suitable for the conversion of implicit knowledge into explicit knowledge (Nicolini *et al*. 2018). Another knowledge mechanism is document transfer. Physical and electronic documents usually are in the form of reports on lessons learned, process written descriptions, final reports, audio, video, and computer files (Feller *et al*., 2009; Lee and Al-Hawamdeh, 2002). Documents containing explicit knowledge can facilitate communication (Prevot, 2005). Effective transfer of documents between network members will facilitate knowledge transfer. In addition to those above, some other research has referred to IOKMs that their description is presented in Table 1.

---

Please insert Table 1 here

---

### *2.2 The characteristics of IOKMs*

Studies introduce various characteristics for IOKMs, including capacity, richness, territory, the extent of access to knowledge, interactivity or ability to feedback, formalization, duration, and cost (Rebentisch and Ferretti, 1995; Prevot, 2007; Dyer and Nobeoka, 2000; Distanont *et al*., 2012; Van Waveren *et al*., 2017; Almeida and Grant, 1998; Sako, 2004; Spraggon and Bodolica, 2012; Pemsel *et al*., 2018). The firm must trade-off between these features to set its portfolio of IOKMs. For example, the greater the interactivity of the mechanism is, the higher the cost and time of its application are. The greater the capacity of a mechanism is, the less

likely the richness and extent of access to knowledge are. It is typically preferred that the IOKMs used to have higher capacity and lower operating costs (Chai and Yap, 2004). However, the characteristics of the knowledge required and the different stages of the knowledge sharing process have a significant impact on the type of IOKMs used (Chai, 2003; Chai and Yap, 2004). Besides, different knowledge needed in product development phases requires different types of IOKMs (Chiesa and Manzini, 1996). The combination of these conditions makes the selection of IOKMs crucial for a firm to increase the efficacy of its knowledge sharing (Spraggon and Bodolica, 2012). Table 2 depicts the above characteristics.

---

Please insert Table 2 here

---

**2.3 Networking capability**

Networking capability (NC) is defined as a set of organizational activities and routines that are implemented at the firm level to establish, develop, and complete business relationships and to gain an advantage by the firm (Miterga *et al*., 2012). Besides, researches consider NC is essential to coordinate, organize, control, exchange, and steer staffing capabilities to develop and manage networks (Mokhtarzadeh *et al*., 2020). In this paper, we focus on the sub-capabilities introduced by the study of Ripollés and Blesa (2018) presented in Table 3.

---

Please insert Table 3 here

---

**2.4 LCFs**

LCFs are firms that follow the innovation path in reverse and through the stages of pure imitation, creative imitation, and innovative imitation, respectively (Kim, 1998). In pure imitation, the LCFs merely assembles the leading firms' products. In creative imitation, the LCFs redesign existing products by making minor changes. In innovative imitation, the firm develops products with its design. In this regard, the LCFs concept has been widely used in catch-up firm-level studies. Existing literature argues that LCFs firms face two disadvantages in following the catch-up path: technological disadvantage and market disadvantage. Technological disadvantage refers to the isolation of international technology centers, and market disadvantage relates to the dislocation of global markets. Some studies have also referred to disadvantages such as switching costs, reputation preemption, and learning curve (Mokhtarzadeh *et al*., 2016). Since the learning orientation and object (Kim, 1998, Lee, 2005) are different during multiple catch-up stages, the IOKMs required by the LCFs will also vary, as research shows that different catch-up stages require different approaches (Lee, 2005). Therefore, it can be concluded that prioritizing inter-organizational knowledge mechanisms has practical lessons learned for LCFs during the catch-up process.

**3. Methodology**

In this research to classify IOKMs and to investigate their effects on NCs, a multi-layer decision-making approach has been designed. In this regard, the research is debuted from studying relevant literature and extracting IOKMs, their characteristics, and NCs. Afterward, the data-gathering stage has been implemented for the required information from the expert's

opinions. Eventually, the analysis of the available data has been employed by multi-criteria decision-making approaches, and the reliability of the results are discussed.

Based on the literature review, a few studies which have classified IOKMs employed a variety of methodologies. These methodologies can be divided into three categories such as review and conceptual studies (Chai and Yap, 2004; Spraggon and Bodolica, 2012), qualitative studies (Rebentisch and Ferretti, 1995; Almeida and Grant, 1998; Dyer and Nobeoka, 2002; Chai, 2003; Sako, 2004; Pemsel et al., 2018) and quantitative studies (Prevot, 2007; Distanont et al., 2012; Van Waveren et al., 2017). Since our research conducted in the context of LCFs, and a limited number of companies usually employ IOKMs successfully in this context, we have used focus groups to collect data and expert-based decision-making methods to analyze them. Although expert-oriented methods have been used in many studies for classification to our knowledge, this study is one of the first researches employing expert-oriented techniques to classify IOKMs. Each of the research steps will be described below.

**Systematic literature review.** The purpose of this phase of research is to provide a comprehensive list of IOKMs and their characteristics. The authors adopted a systematic review approach (Tranfield *et al*., 2003) in this phase of research. This approach requires a specific procedure for identifying, selecting, and synthesizing the studies. The first stage in the process of the systematic review is identifying the preamble studies. The following keywords were considered for the search: "inter-organizational knowledge mechanisms", "knowledge sharing mechanisms", "knowledge transfer mechanisms", and "knowledge governance mechanisms", "knowledge mechanism characteristics", and "knowledge mechanism criteria." The search began in early 2019 and ended three months later. Searches were performed in Google Scholar and Scopus online databases. A total of 315 items were obtained from the initial search process.

The authors used the 'Preferred Reporting Items for Systematic Reviews and Meta-Analyses' (PRISMA) (Moher et al., 2009; Liberati et al., 2009) to reach the final sample (Fig. 1). First, duplicates were deleted, remaining 286 items. Then, by reviewing the studies in a title-abstract-keyword manner, unrelated cases were separated. The number of remaining studies in this step was 75. After that, the items were studied to assess their quality based on Sandelowski and Barroso's (2007) measures. Forty-five items were removed in this step. Subsequently, the database was reviewed in a full-text manner. While reading the studies, some of their references appeared to be hidden in the search process and had the potential to enter the study database. Thus, 4 items were added to the sample in this step. Eventually, the sample of the review was finalized by 34 studies. The last stage in the process of the systematic review is synthesizing the body of literature. We pursued a comprehensive list of mechanisms and their characteristics in this stage and carefully reviewed the studies and identified mechanisms that were inter-organizational. Then, by combining the literature, IOKMs were clearly identified. Finally, the same process was repeated for the characteristics of IOKMs.

---

Please insert Figure 1 here

---

**Data Gathering.** To evaluate and classify the available IOKMs based on identified characteristics and to investigate the effect of the classified IOKMs on NCs, the 'expert's

opinion has been considered. In this regard, six focus groups of experts from different sectors and businesses are considered with qualifications in knowledge management, NCs, and inter-organizational collaborations are considered. Executive managers from companies in Iran participated in this research. The expert profile is presented in Table 4. Sampling criteria for expert selection are as follows (Kortmann *et al*., 2014):

- Job position (Management-level),
- Job title (chief executive officers, chief technology officers, knowledge managers, R&D managers, alliance managers, product manager, project managers, engineering manager, production manager),
- Work experience (More than 10 years),
- Duration of cooperation with the company (More than 5 years),
- Level of education (Bachelor, at least),
- Level of familiarity with the IOKMs and NC (More than average in the Likert scale).

---

Please insert Table 4 here

---

After explaining IOKMs (coded from $M_1$ to $M_{19}$) and their characteristics (coded from $C_1$ to $C_8$) and research objectives to the experts, each group of experts evaluates each mechanism ($MC_i$) based on criteria ($C_j$). Furthermore, the importance of each criterion ($W_j$) is also determined by the experts using two questionnaires ($Q_A$, $Q_B$) with a seven pull-down linguistic terms scale including *strongly effective, effective, nearly effective, neither effective nor ineffective, nearly ineffective, ineffective, strongly ineffective* has been designed. These linguistic variables are transferred to quantitative values in Table 5.

---

Please insert Table 5 here

---

Remark that the data gathering in this research consists of two stages. In the first stage of data gathering, the importance of criteria and IOKMs assessment based on each criterion is extracted from experts. Then, by applying a multi-criteria decision-making approach, the importance of ' criteria's, and the evaluation of IOKMs are measured. As a result, the IOKMs are classified into four clusters. In the second stage of data gathering, the third questionnaire ($Q_c$) was applied to identify the effect of each mechanism cluster ($MC_i$) on networking capabilities ($NC_j$).

**Data Analysis.** After the data-gathering phase, three main objectives are scheduled for data analysis. First, to evaluate the importance of criteria (by SWARA), then to evaluate and classify the IOKMs based on weighted 'criteria's (by CoCoSo and quartile analysis) and to assess the cluster's effect on NCs. In this regard, a hybrid Stepwise Weight Assessment Ratio Analysis (SWARA) and combined compromise solution (CoCoSo) method has been designed as follows.

**SWARA Method.** Among all possible criteria evaluation methods (e.g. 'Shannon's entropy, Best Worst Method (BWM), Factor relationship evaluation (FARE)), SWARA is one of the most popular methods that have been used for many assessment problems (Beheshti *et al*., 2016; Mahdiraji et al, 2019). This method is different from other similar methods and makes the decision-maker capable to select their priority based on the current situation of the environment and economy. Moreover, the expert's role in evaluations and calculating weights is significant (Zolfani *et al*., 2013; Hajiagh et al, 2018). Based on this method (Keršuliene *et al*., 2010; Mahmoudi et al, 2019) first, the criteria are sorted based upon the mean point of the expert's questionnaire ($P_j$). Then, the setpoint of each criterion known as $S_j$ is measured as follows.

$$S_j = \begin{cases} P_j, j = 1 \\ \left|P_j - P_{j-1}\right|, j > 1 \end{cases} \quad (1)$$

Then, the primary coefficient $K_j$ is obtained as follows.

$$K_j = \begin{cases} 1, j = 1 \\ S_j + 1, j > 1 \end{cases} \quad (2)$$

Afterward, the initial weight is known as $Q_j$ is calculated as follows.

$$Q_j = \begin{cases} 1, j = 1 \\ \dfrac{Q_{j-1}}{K_j}, j > 1 \end{cases} \quad (3)$$

Eventually, the normalized weights $W_j$ is calculated as follows.

$$W_j = \frac{Q_j}{\sum_{j=1}^{n} Q_j} \quad (4)$$

**CoCoSo Method.** This method is a newly proposed and reliable algorithm to evaluate alternatives based on different criteria. The method was initially introduced in 2019 (Yazdani *et al.*, 2019) and was developed for uncertain versions including Pythagorean Fuzzy (Taghavifard et al, 2018; Peng *et al.*, 2019), Grey/Interval (Yazdani *et* al., 2019), interval rough (Erceg *et* al., 2019), fuzzy CoCoSo (Ecer and Pamucar, 2020) and Hesitant fuzzy (Wen *et al*., 2019). This method has been recently used for many scientific investigations including the assessment of sustainable development goals (e.g. Stanujkic *et al*., 2020), facility location problems (e.g. Ulutas *et al*., 2020), performance assessment problems (e.g. Wen *et al*., 2019; Kharwar *et al*., 2020), stock management (e.g. Erceg *et al*., 2019) and supplier selection (e.g. Zolfani *et al.,* 2019; Ecer and Pamucar, 2020). This wide range of applications demonstrates this fact that this method is a popular and reliable algorithm for any multi-criteria decision-making problem. Hence, in this research, the CoCoSo method has been employed to compare the results of knowledge management drivers based on different types of businesses and industries. By applying this method, the knowledge management drivers are assessed in different industries based on their executive manager's opinions. Furthermore, the considered method is capable to investigate and analyze the effects of expert's opinion changes on the final

ranking. This aspect is missing in many well-known decision-making methods including TOPSIS or AHP; thus, the authors have used this advantage to investigate the reliability of the initial results. The five-step CoCoSo method is presented as follows.

(1) Design the initial decision-making matrix as follows. Note that $x_{ij}$ is the assessment is the $i^{th}$ alternative based on $j^{th}$ criteria.

$$x_{ij} = \begin{bmatrix} x_{11} & \cdots & x_{1n} \\ \vdots & \ddots & \vdots \\ x_{m1} & \cdots & x_{mn} \end{bmatrix} \quad (5)$$

i=1,2,…,m ; j= 1,2,…,n

(2) Based on the benefit and cost criterion, by using the two following formulas, the initial decision-making matrix is normalized. Note that $r_{ij}$ is the normalized value of the $i^{th}$ alternative based on $j^{th}$ criteria.

$$Benefit \rightarrow r_{ij} = \frac{x_{ij} - \min(x_{ij})}{\max(x_{ij}) - \min(x_{ij})} \quad (6)$$

$$Cost \rightarrow r_{ij} = \frac{\max(x_{ij}) - x_{ij}}{\max(x_{ij}) - \min(x_{ij})} \quad (7)$$

(3) The total of the weighted comparability sequence (S) and the whole of the power weight of comparability sequences (P) for each alternative is calculated by the two following formulas.

$$S_i = \sum_{j=1}^{n} (w_j . r_{ij}) \quad (8)$$

$$P_i = \sum_{j=1}^{n} (r_{ij})^{w_j} \quad (9)$$

(4) The arithmetic mean of sums of $P_i$ and $S_i$ scores ($k_{ia}$), the sum of relative scores of $P_i$ and $S_i$ compared to the best ($k_{ib}$) and the balanced compromise of $P_i$ and $S_i$ scores ($k_{ic}$) are all calculated by following formulas. In equation (8) Lambda is determined by decision-maker and usually near 0.5.

$$k_{ia} = \frac{P_i + S_i}{\sum_{i=1}^{m} (P_i + S_i)} \quad (10)$$

$$k_{ib} = \frac{S_i}{Min\ (S_i)} + \frac{P_i}{Min\ (P_i)} \quad (11)$$

$$k_{ic} = \frac{\lambda P_i + (1-\lambda).S_i}{[\lambda . Max(S_i)] + [(1-\lambda).Max(P_i)]} \quad (12)$$

(5) The final evaluation and ranking of alternatives ($k_i$) are emanated from the following formula (Yazdani *et al.*, 2019).

$$k_i = (k_{ia}.k_{ib}.k_{ic})^{\frac{1}{3}} + (\frac{1}{3}[k_{ia}+k_{ib}+k_{ic}]) \quad (13)$$

(6) To classify the alternatives, based on the final score ($k_i$) the clusters are designed as following rules.

(6.1) **Green Class (A).** If the final score is more than the third quartile of ($k_i$),

(6.2) **Yellow Class (B).** In the final score is between the median and the third quartile of ($k_i$),

(6.3) **Blue Class (C).** In the final score is between the first quartile and the median of ($k_i$),

(6.4) **Red Class (D).** The final score is below the first quartile of ($k_i$).

(7) Finally, the effect of these classes on networking capabilities are measured through normalizing.

## 4. Findings and Results

By considering the stages mentioned in Figure 1, the results are presented to evaluate, cluster, and rank different IOKMs regarding their characteristics. First, the questionnaires are completed by the experts. As a result, the 'expert's opinion regarding the importance of eight extracted criteria is illustrated as Table 2 After, the linguistic variables are converted to quantitative values (According to Table 5). Then, the average importance of each criterion is calculated by arithmetic mean. Eventually, by normalizing the aggregated importance, and implementing the SWARA method (equation (1) to (4)) the final weight of each criterion is emanated and illustrated in Table 6.

---

Please insert Table 6 here

---

In the next step, the main decision-making matrix (DMM) which includes the assessment of knowledge mechanisms by their characteristics, is considered. By completing the second questionnaire from the experts, the DDM is emanated. Then the linguistic variables are transferred to quantitative values (According to Table 5). Eventually, the average value of each cell is calculated by arithmetic mean. By running the CoCoSo method and algorithm, in the first step, the DMM in transferred to a normal decision-making matrix by equations (6) and (7) according to the type of the criteria. After extracting the normalized DMM, the CoCoSo algorithm is implemented step by step and the results of a total of the weighted comparability sequence (S) and the whole of the power weight of comparability sequences (P) by equations (8) and (9); arithmetic mean of sums of $P_i$ and $S_i$ scores ($k_{ia}$), the sum of relative scores of $P_i$ and $S_i$ compared to the best ($k_{ib}$) and the balanced compromise of $P_i$ and $S_i$ scores ($k_{ic}$) by equations (10) to (12); eventually, the final score of each knowledge ($k_i$) by equation (13) are all measured and presented in Table 7. Note that the lambda value is considered 0.5 for the moderate situation and logical choice of experts. The effect of the Lambda parameter on the evaluation of the knowledge mechanism is analyzed further.

---

Please insert Table 7 here

---

After measuring the final score for each IOKM ($K_i$), the alternatives are ranked and clustered upon their final score. According to the classification rules designed by the researchers. The IOKMs are classified as in Table 7. The typological analysis of this study has led to the

formation of four categories of mechanisms: person-to-person, co-creation, team-oriented, and informational mechanisms. First, the four classes of IOKMs are described below.

***Person-to-person mechanisms (blue).*** These mechanisms have been emphasized in previous studies, and their main feature is face-to-face interactions between individuals (Iddy, 2020). From a tacit-explicit dichotomy perspective, this group's mechanisms are suitable for the transfer of tacit knowledge. In a specific catch-up context, these mechanisms are used for communication between LCFs employees and leading firm's specialists and other network partners to transfer the required knowledge. These mechanisms, especially, are employed in the early stages of the catch-up process. According to Figure 2, the configuration of this category's characteristics is as follows: high capacity, high richness, limited territory, the low extent of access to knowledge, high interactivity, low formalization, relatively high costs, and low duration. Regarding the "supplier certification" mechanism, it is noteworthy that a specific person from the network's focal firm usually comes to the suppliers' site and audits the processes according to a particular standard by holding meetings and providing person-to-person explanations. Our interviews show that the knowledge shared in the form of this mechanism is usually exchanged between the chief auditor of the focal firm and supplier's main interface. Therefore, it can be assumed that it is relevant to place this mechanism in this category.

***Co-creation mechanisms (yellow).*** Our research shows that this category has not been identified in previous studies. The main contribution of this category is its concentration on knowledge combination and creation in addition to knowledge sharing. Moreover, this category is more focused on design function, which has an innovative nature. Accordingly, this category is labeled as co-creation. The examination of previous studies shows that mechanisms have not yet been categorized from a knowledge sharing-creation dichotomy perspective. Therefore, the introduction of this category has a contribution. The knowledge formed by these mechanisms is collective and context-dependent, and it has a significant impact on competitive advantage. In LCFs, these mechanisms are generally used to adaptation and localization of parts and system-level redesign of existing products, and they contribute to the LCFs creative learning. According to Figure 2, the configuration of this category's characteristics is as follows: high capacity, high richness, wide territory, the high extent of access to knowledge, high interactivity, high formalization, low costs, and low duration. In this category, "production audits" seem to be different from other mechanisms. However, based on our investigation, the production audit process is usually carried out with various teams inside and outside the organization. From a holistic perspective, product and process quality is judged in a networked manner over a relatively long period. According to our gathered data, by extracting defects, production audits have knowledge creation that is the result of the knowledge combinations of different groups present in audit meetings. Therefore, it can be assumed that it is relevant to place this mechanism in this category.

***Team-oriented mechanisms (green).*** Compared to person-to-person mechanisms where more knowledge flows at the interpersonal level, in this category, knowledge is exchanged at the intergroup level. The team nature of knowledge exchange is the main distinguishing feature

and the reason for naming this category. The complementariness of team members' understanding of a single knowledge leads to greater effectiveness. It is worth noting that new knowledge may be created in some mechanisms of this category. Previous studies state that mechanisms have not yet been categorized from an individual-group dichotomy perspective. Therefore, the introduction of this category has a contribution. In a specific catch-up context, this category's mechanisms are particularly suitable for strengthening creative learning around the LCFs network. Based on Figure 1, the configuration of this category's characteristics is as follows: high capacity, high richness, wide territory, the high extent of access to knowledge, high interactivity, low formalization, low costs, and high duration. Among the mechanisms of this category, it can be said that "virtual dynamic processes" can be used individually and in groups. Our interviews suggest that in most cases, knowledge sharing in cyberspace is done through the formation of workgroups, and the use of these tools at the group level has been more than the individual level. In other environmental conditions, this mechanism may be placed in "person-to-person" mechanisms.

***Informational mechanisms (red).*** These mechanisms, mentioned in previous studies, are mostly used to exchange explicit knowledge. The term "informational" was chosen based on this feature, confirming their low potential for the transfer of tacit knowledge. In the "forums" mechanism, experts cannot exchange tacit knowledge in the short time they are together, so knowledge transfer does not exceed a certain level. The same applies to mechanisms such as document transfer and financing of R&D projects, mostly in the form of written reports. In the specific context of LCFs, these mechanisms are used to initiate communication between the LCFs and their external partner in the early stages of the catch-up process. Information transfer plays an essential role in facilitating the imitation of leading firms. Based on Figure 1, the configuration of this category's characteristics is as follows: low capacity, low richness, limited territory, the low extent of access to knowledge, low interactivity, high formalization, high costs, and low duration. It may seem that "forums" should not be placed in this category. However, since the short duration of forums does not allow for deep interactions and the level of knowledge exchange is not high, this mechanism is in this category. It should be noted that the quality of forums varies in different contexts and issues. Based on the experts' results, Figure 2 shows the status of the four classes of mechanisms in each of the characteristics.

---

Please insert Figure 2 here

---

**Sensitivity Analysis.** To analyze the results emanated from the data gathered by experts and the CoCoSo method, some sensitivity analyses are applied to check the reliability of the results. First, considering that the Lambda parameter was considered 0,5 in this research, the changes in this value and the effects on the final clustering of knowledge mechanisms is important. In this regard, the possible values of Lambda from 0.1 to 0.9 are used and the CoCoSo algorithm and the clustering approach was investigated accordingly. The results of the clusters are presented in Figure 3a and 3b.

---

Please insert Figure 3a here

---

---

Please insert Figure 3b here

---

As the above figure demonstrates, the cluster and the class of each mechanism is not changing significantly by the changes of lambda. This reveals that although with pessimistic and optimistic experts and with alternating the lambda value, the final classification and ranking of the knowledge mechanisms are not significantly changing. Remark that, according to Figure 3, the classification presented in this research is potentially reliable. Moreover, the effect of the changes of lambda on the final score of the mechanisms is analyzed. As Figure 3b denotes, the final score of the mechanisms is increasing while the value of lambda ascends. This increase follows a slight exponential behavior; however, no up-down behavior was observed. Thus, the results are stable and the changes in the final scores and rankings are predictable and rationale. Accordingly, to assess the effect of each cluster on networking capabilities based on expert's opinions, the third questionnaire has been completed by six groups of experts again. The gathered responses are analyzed and normalized as follows.

---

Please insert Table 8 here

---

Table 8 contains two main parts; Part A shows which clusters of mechanisms have the greatest impact on an NC. Part B confirms that NC is mostly affected by which cluster of mechanisms. Based on the results of Part A, since the co-creation mechanisms have the functions of knowledge sharing and creation simultaneously, they seriously enhance inter-organizational knowledge-sharing ability. Co-creation essentially requires dominating knowledge sharing. Besides, our findings show that team-oriented and co-creation mechanisms enhance the inter-organizational coordination ability. Since team building is one of the main ways to increase coordination, team-oriented mechanisms have a significant effect on improving the inter-organizational coordination ability of the focal firm. The complexities of technological knowledge creation allow for co-creation within inter-group relationships that require technical and managerial coordination between collaborative teams. The results show that the formation of conflict resolution and adaptation abilities also largely depends on the implementation of team-oriented and co-creation mechanisms. The learning of conflict resolution usually occurs in the context of design and supply functions because interactions in such functions are more complex, and consequently, the rate and severity of conflicts are higher. The ability to adapt to new partners' needs and new circumstances also requires partner knowledge acquisition. Team-oriented and co-creation mechanisms, due to their inter-organizational interactions, deepen the network partners' understanding of each other. Finally, according to Part A of Table 8, the improvement of resource sharing ability is influenced by person-to-person mechanisms. Interviews with experts show that network members' shared use of equipment, laboratories, test rooms, and other organizational resources is influenced by interpersonal communication.

Coordination among senior managers of network members facilitates this sharing. As mentioned earlier, Part B of Table 8 shows that each cluster of mechanisms further enhances which networking capability. Team-oriented and co-creation mechanisms have a greater impact on inter-organizational coordination and adaptation. These mechanisms provide the basis for continuous and long-term interaction between the focal firm and network members. On the other hand, person-to-person mechanisms further enhance adaptation capability because interpersonal communication facilitates mutual understanding of network members' needs as well as environmental changes affecting the network. Finally, informational mechanisms improve inter-organizational knowledge sharing, conflict resolution, and adaptation. The wide range of mechanisms in this category has enhanced a variety of abilities.

## 5. Conclusion

The lack of resources and capabilities required by firms to achieve their technological and market goals has led them to have numerous inter-organizational collaborations (Lavie, 2006). Meanwhile, the competitive significance of knowledge resources has caused many firms to employ a collaboration strategy for knowledge co-creation (Hitt *et al.*, 2000). The necessity of decreasing the LCFs knowledge gap makes managing inter-organizational knowledge relationships much more crucial for them in the catch-up process (Figueiredo, 2017). Moreover, the success of inter-organizational collaborations highly depends on the efficient management of knowledge mechanisms, which is affected by the process of mechanism selection (Easterby-Smith et al., 2008). Besides, practical experiences reveal that IOKMs strengthen NCs (Knoppen et al., 2011). Therefore, categorizing IOKMs and explaining their impact on NC can be a useful way of opening the black box of how companies, especially LCFs, employ IOKMs.

### 5.1 Contributions

The present study has a theoretical contribution from two standpoints to the knowledge management and inter-organizational collaboration fields. First, we provide a framework for categorizing the various IOKMs that can help LCFs select them. The dynamics of the catch-up process indicate the great importance of choosing the right mechanism at the right time. In the early stages of the catch-up process, technological learning requires know-how acquisition along with equipment and hardware transfer. Then, imitative learning becomes creative learning, and it requires new knowledge creation. Such a situation poses serious challenges in the selection of mechanisms, and the long list of mechanisms sometimes confuses managers and reduces the effectiveness of the mechanism selection. By presenting a new typology, this study has summarized and organized the existing IOKMs. Consequently, the classification of this study provides managers with a useful framework for selecting mechanisms.

Second, another issue that helps select mechanisms is how to strengthen NC. The literature places great emphasis on the networking capability on the catch-up path (Cho and Lee,2003). Therefore, one of the main goals of implementing IOKMs is to strengthen NC. By examining the effect of mechanisms on NC, this study has identified which NC is affected by which cluster of IOKMs. Based on the study's framework, LCFs can select the mechanism they need

according to their NC. Among the few research that classify IOKMs, only a few studies have named different categories. Meanwhile, people-based and technology-based mechanisms (Chai and Yap, 2004); moderate, relational, complete, and technical mechanisms (Prevot, 2007); soft-hard mechanisms (Jasimuddin et al., 2009); formal codification, training and coaching, informal person-to-person, and communal mechanisms (Van Waveren *et al*., 2017); and technological, social, documental and events mechanisms (Balle et al., 2019) have been introduced. Our research shows that our classification has a contribution in two respects compared to previous studies. This study introduces two new categories of team-oriented and co-creation mechanisms that have been neglected in previous studies. Moreover, based on data collected from in-depth focus groups, progress at each stage of the catch-up process requires applying specific IOKMs. In the early stages of catch-up, the LCFs take advantage of person-to-person and informational mechanisms. Then, as the firm progressed, more team-oriented mechanisms are used. Eventually, the latecomers move toward using co-creation mechanisms. Therefore, another distinction of this study from similar previous research is to find this preliminary pattern of applying IOKMs at different stages of the catch-up process. Ultimately, in this research, a multi-layer decision-making approach has been scheduled utilizing novel and highly reputable methods including SWARA-CoCoSo. This hybrid approach has been designed by the authors and eventually, to classify the knowledge mechanisms a quartile analysis of the final score emanated from the hybrid approach has been adopted. Besides, to examine the knowledge clusters influence on the networking capabilities has been resulted by a simple normalization method. This combination of methods has guided this research to achieve the research objectives.

### 5.2 Implications

In addition to the contributions, this study also has practical implications. Based on knowledge characteristics and contextual conditions, if the focal firm requires high capacity, high richness, wide territory, the high extent of access, and high interactivity, it is better to use co-creation and team-oriented mechanisms. The criterion that distinguishes between co-creation and team-oriented mechanisms is the degree of formalization. If the firm needs formality, it is better to use co-creation mechanisms. However, it is better to use person-to-person mechanisms if limited territory and low extent of access to knowledge are required. Finally, it can be said that informational mechanisms can be used when the nature of the knowledge required is explicit, and the level of formalization is high. In general, the costs of co-creation and team-oriented mechanisms are lower than the costs of implementing person-to-person mechanisms due to their participatory nature, as compensation for human resource transfer and rotation at the network level is costly. In terms of duration, team-oriented mechanisms are also more time-consuming due to long-term relationships.

In addition to classification, the mechanism cluster's impact on NC can also provide guidelines for their selection. The findings of this study show that if the organization seeks to strengthen its knowledge-sharing ability, it can use all four categories of IOKMs, noting that the impact of co-creation mechanisms will be higher. It is better to use co-creation and team-oriented mechanisms if the goal is to improve coordination, conflict resolution, and adaptation. Finally, if managers intend to improve resource sharing ability, it is best to use person-to-person

mechanisms. Employing the results of this study and considering the dedicated organizational context, managers can develop a roadmap to improve NCs using IOKMs. By considering the current NC level, this roadmap determines which NCs should be improved by selecting which IOKMs in a certain timeframe. Totally, the results of this study will help firms to increase their horizontal alignment by adjusting the knowledge strategy to the collaboration strategy.

### 5.3 Limitations and Further Research

The focus of the present study on a specific context (Iranian LCFs) overshadows the generalizability of its results. For instance, since experts belong exclusively to a specific geographic territory, the external validity of the research may be constrained. It is suggested that future research repeat the same research in different contextual conditions. In line with this, future research could also address the more comparison between the use of IOKMs in developed and developing countries (Iddy, 2020). Furthermore, future studies can examine the differences between small and large as well as a newcomer and incumbent firms in using IOKMs. Another significant factor influencing the use of IOKMs is the firm's position in the network (Balle et al., 2019). Although the present study focuses on focal firms, it is suggested that other scholars pay attention to other network members, depending on the degree of centrality.

One of the strengths of this research is the use of a multi-layered decision-making technique in which the systematic review of the literature has been combined with new quantitative methods. The SWARA method adopted in this research determines the importance of the criterias; however, it deals with insufficient consistency ratio compared with other similar methods (e.g. Best Worst Method (BWM), LINMAP, etc.). Furthermore, as this research has implemented the deterministic version of the CoCoSo method, final scores presented in this research can be investigated under uncertain circumstances to illustrate more realistic classifications (e.g. Fuzzy sets, Grey systems, Intuitionistic Fuzzy sets, etc.). Moreover, to pinpoint the effects of knowledge mechanism's on networking capabilities, increasing the sample size, and utilizing rigid data instead of expert's opinions could be considered in future studies. Besides, further research can also use qualitative and mixed methods and case studies to identify appropriate mechanisms for each stage of the catch-up process. Another limitation of this research is the choice of cross-sectional design; other studies must increase the validity of our results by adopting a longitudinal approach. By and large, uncertain decision-making approaches, including fuzzy sets, grey systems, hesitant fuzzy sets, and intuitionistic fuzzy sets, are also capable of demonstrating more realistic results for higher complexity and instability of the environment.

## References


Ardito, L., Messeni Petruzzelli, A., & Albino, V. (2019a). The Influence of Alliance Ambidexterity on Innovation Performance and the Moderating Role of Firm Age. *IEEE Transactions on Engineering Management*, 1-8.

Ardito, L., Peruffo, E., & Natalicchio, A. (2019b). The Relationships between the Internationalization of Alliance Portfolio Diversity, Individual Incentives, and Innovation Ambidexterity: A Microfoundational Approach. *Technological Forecasting and Social Change*, 148), 119714.

Balle, A. R., Steffen, M. O., Curado, C., & Oliveira, M. (2019). Interorganizational knowledge sharing in a science and technology park: the use of knowledge sharing mechanisms. *Journal of Knowledge Management*.

Beheshti, M. Mahdiraji, H.A. and Zavadskas, E.K. (2016), Strategy portfolio optimisation: A copras g-modm hybrid approach. *Transformations in Business and Economics*, Vol. 15 No.1, pp.41-60.

Belkadi, F. Vlachou, E. Kumar-Gupta, R. Zogopoulos, V. Kaya, M. Bernard, A. Mourtzis, D. Natalizio, S. Büyükdığan, B.G. and Bayrak, I.T. (2018) Modularity as a support for frugal product and supplier network co-definition under regional market constraints: a mirroring hypothesis application, *International Journal of Production Research*, Vol. 56 No.20, pp.6575-6590.

Bell, M., & Figueiredo, P. N. (2012). Innovation capability building and learning mechanisms in latecomer firms: recent empirical contributions and implications for research. *Canadian Journal of Development Studies/Revue canadienne d'études du développement*, *33*(1), 14-40.

Chai, K.H. and Yap, C.M. (2004), Effective knowledge transfer in virtual teams: linking contents and mechanisms. *International journal of networking and virtual organisations*, Vol. 2 No. 4, pp.312-322.

Chesbrough, H.W. (2006) *Open Business Models: How to Thrive in the New Innovation Landscape*, Harvard Business School Press, Boston.

Chiesa, V. and Manzini, R. (1996) 'Managing knowledge transfer within multinational ' firms', *International Journal of Technology Management,* Vol. 12 No. 4, pp.462–475.

Cho, H.D. and Lee, J.K. (2003), The developmental path of networking capability of catch-up players in Korea's semiconductor industry. R&D Management, Vol. 33 No. 4, pp. 411-423.

Collinson, S. (2013), *The making of an innovative multinational firm: Chinese capability development through the acquisition of MG-Rover* (No. 2013-04), Birmingham Business School Discussion Paper Series.

De Meyer, A. (1991) 'Tech talk: how managers are stimulating global R&D 'communication', *Sloan Management Review*, Vol. 32 No. 3, pp.49–58.

Distanont, A. Haapasalo, H. Rassameethes, B. and Lin, B. (2012), Knowledge transfer pattern in collaborative product development. *International Journal of Intercultural Information Management*, Vol. 3 No. 1, pp.59-81.

Dixon-Woods, M. Agarwal, S. Jones, D. Young, B. and Sutton, A. (2005), Synthesising qualitative and quantitative evidence: a review of possible methods. *Journal of health services research & policy*, Vol. 10 No. 1, pp.45-53.

Dyer, J.H. and Nobeoka, K. (2000), Creating and managing a high-performance knowledge-sharing network: the Toyota case. *Strategic management journal*, Vol. 21 No. 3, pp.345-367.

Easterby-Smith, M. Lyles, M.A. and Tsang, E.W. (2008), Inter-organizational knowledge transfer: Current themes and future prospects. Journal of management studies, Vol. 45 No. 4, pp.677-690.

Ecer, F. and Pamucar, D. (2020). Sustainable supplier selection: A novel integrated fuzzy best worst method (F-BWM) and fuzzy CoCoSo with Bonferroni (CoCoSo'B) multi-criteria model. *Journal of Cleaner Production*, Vol. 266 No. 1, pp. 122-142.

Erceg, Ž. Starčević, V. Pamučar, D. Mitrović, G. Stević, Ž. and Žikić, S. (2019), A New Model for Stock Management in Order to Rationalize Costs: ABC-FUCOM-Interval Rough CoCoSo Model. *Symmetry*, Vol. 11 No. 12, pp.1527-1540.

Feller, J. Parhankangas, A. and Smeds, R. (2009), Inter-partner relationship, knowledge transfer mechanisms, and improved capability to manage R&D alliances: evidence from the telecommunications industry. International Journal of Technology Management, Vol. 47 No. 4, pp.346-370.

Figueiredo, P. N. (2017). Micro-level TC accumulation in developing economies: insights from the Brazilian sugarcane ethanol industry. Journal of cleaner production, 167, 416-431.

Hajiagha, S. H. R., Mahdiraji, H. A., Tavana, M., & Hashemi, S. S. (2018). A novel common set of weights method for multi-period efficiency measurement using mean-variance criteria. *Measurement*, *129*, 569-581.

Hansen, U. E., & Lema, R. (2019). The co-evolution of learning mechanisms and technological capabilities: Lessons from energy technologies in emerging economies. *Technological Forecasting and Social Change*, *140*, 241-257.

Harrington, T.S. Srai, J. S. and Kumar, M. (2019), Knowledge management in SMEs and MNCs: matching knowledge mobility mechanisms to supply network configuration profiles. *Production Planning & Control*, Vol. 30 No. 10-12, pp.971-994.

Hawkins, M.A. and Rezazade, M. H. (2012), Knowledge boundary spanning process: synthesizing four spanning mechanisms. *Management Decision,* Vol. 50 No. 10, pp.1800-1815.

Hitt, M.A. Ireland, R. D., and Lee, H. U. (2000), Technological learning, knowledge management, firm growth and performance: an introductory essay. *Journal of Engineering and Technology management*, Vol. *17 No.* 3-4, pp.231-246.

Iddy, J. J. (2020). Knowledge transfer mechanisms in franchise network. *Journal of Knowledge Management*.

Jasimuddin, S.M. Connell, C. and Klein, J. H. (2014), A decision tree conceptualization of choice of knowledge transfer mechanism: the views of software development specialists in a multinational company. *Journal of Knowledge Management*, Vol. 18 No. 1, pp.194-215.

Jasimuddin, S.M. and Zhang, Z. (2009), The symbiosis mechanism for effective knowledge transfer. *Journal of the Operational Research Society*, Vol. 60 No. 5, pp.706-716.
Keršuliene, V. Zavadskas, E.K. and Turskis, Z. (2010) Selection of rational dispute resolution method by applying new step-wise weight assessment ratio analysis (SWARA). *Journal of business economics and management*, Vol. 11 No. 2, pp.243-258.
Kharwar, P.K. Verma, R.K. and Singh, A. (2020), Neural network modeling and combined compromise solution (CoCoSo) method for optimization of drilling performances in polymer nanocomposites. *Journal of Thermoplastic Composite Materials*, 0892705720939165.
Kiernan, L. Ledwith, A. and Lynch, R. (2019), Design teams management of conflict in reaching consensus. *International Journal of Conflict Management*, Vol. 31 No. 2, pp.263-385.
Kim, L. (1998), Technology Policies and Strategies for Developing Countries: Lesson from Korean Experience. Technology Analysis and Strategic Management. Vol. 10 No. 3, pp. 331-323.
Knoppen, D. Sáenz, M.J. and Johnston, D.A. (2011), Innovations in a relational context: Mechanisms to connect learning processes of absorptive capacity. *Management Learning*, Vol. 42 No. 4, pp.419-438.
Kortmann, S. Gelhard, C. Zimmermann, C. and Piller, F.T. (2014), Linking strategic flexibility and operational efficiency: The mediating role of ambidextrous operational capabilities. *Journal of Operations Management*, Vol. 32 No. 7-8, pp. 475-490.
Lavie, D. (2006), The competitive advantage of interconnected firms: An extension of the resource-based view. *Academy of management review*, Vol. 31 No. 3, pp. 638-658.
Lee, K. (2005), Making a Technological Catch-up: Barriers and opportunities. Asian Journal of Technology Innovation, Vol. 13 No. 2, pp. 97-131.
Lee, C.K. and Al-Hawamdeh, S. (2002), Factors impacting knowledge sharing. *Journal of Information & Knowledge Management*, Vol. 1 No. 01, pp. 49-56.
Liberati, A., Altman, D. G., Tetzlaff, J., Mulrow, C., Gøtzsche, P. C., Ioannidis, J. P., ... & Moher, D. (2009). The PRISMA statement for reporting systematic reviews and meta-analyses of studies that evaluate health care interventions: explanation and elaboration. *PLoS medicine*, 6(7), e1000100.
Lindgren, J. and Widén, K. (2018), Diffusing building information management–knowledge integration, mechanisms and knowledge development. *Architectural engineering and design management*, Vol. 14 No. 5, pp. 347-362.
Liu, Y. Jiang, C. and Zhao, H. (2018), Using contextual features and multi-view ensemble learning in product defect identification from online discussion forums. *Decision Support Systems*, Vol. 105, pp. 1-12.
Mahdiraji, H. A., Kazimieras Zavadskas, E., Kazeminia, A., & Abbasi Kamardi, A. (2019). Marketing strategies evaluation based on big data analysis: a CLUSTERING-MCDM approach. *Economic research-Ekonomska istraživanja*, *32*(1), 2882-2892.
Mahmoudi, M., Mahdiraji, H. A., Jafarnejad, A., & Safari, H. (2019). Dynamic prioritization of equipment and critical failure modes. *Kybernetes,* 48 (9), 1913-1941.
McIver, D. Fitzsimmons, S. and Lengnick-Hall, C. (2019), Integrating knowledge in organizations: Examining performance and integration difficulties. *Knowledge Management Research & Practice*, Vol. 17 No. 1, pp.14-23.
Minbaeva D. Knowledge transfer in multinational corporations. *Management International Review*, Vol. 47 No. 4, pp.567–93.
Mitrega, M. Forkmann, S. Ramos, C. and Henneberg, S.C. (2012), Networking capability in business relationships: Concept and scale development. Industrial Marketing Management, Vol. 41 No. 5, pp. 739-751.
Moher, D., Liberati, A., Tetzlaff, J., & Altman, D. G. (2009). Preferred reporting items for systematic reviews and meta-analyses: the PRISMA statement. *Annals of internal medicine*, 151(4), 264-269.
Mokhtarzadeh, N.G. Mahdiraji, H.A. Jafari-Sadeghi, V. Soltani, A. and Kamardi, A. A. (2020), A product-technology portfolio alignment approach for food industry: a multi-criteria decision making with z-numbers. *British Food Journal*.
Mokhtarzadeh, N.G. Mahdiraji, H.A. Jafarpanah, I. Jafari-Sadeghi, V. and Cardinali, S. (2020), Investigating the impact of networking capability on firm innovation performance: using the resource-action-performance framework. *Journal of Intellectual Capital*.
Mokhtarzadeh, N. G., Mahdiraji, H. A., Beheshti, M., & Zavadskas, E. K. (2018). A novel hybrid approach for technology selection in the information technology industry. *Technologies*, *6*(1), 34
Mokhtarzadeh, N.G. and Faghei, M. (2019), Technological learning in inter-firm collaborations: a review and research agenda. *International Journal of Technological Learning, Innovation and Development*, Vol. 11 No. 1, pp. 78-96.
Mokhtarzadeh, N. Ahangari, S.S. and Faghei, M. (2016), Proposing a three dimensional model for selecting a portfolio of R&D projects. In *IAMOT 2016 Conference Proceedings*. International Association for Management of Technology Orlando, Florida, USA.

Natalicchio, A., Ardito, L., Savino, T., & Albino, V. (2017). Managing Knowledge Assets for Open Innovation: A Systematic Literature Review. *Journal of Knowledge Management*, 21(6), 1362-1383.

Nobeoka, K. and Baba, Y. (2000), The influence of new 3-D CAD systems on knowledge creation in product development. Knowledge Emergence: Social, Technical, and Evolutionary Dimensions of knowledge creation, 55.

Organisation for Economic Cooperation and Development (OECD) (2013). Interconnected economies: Benefitting from global value chains. Paris: OECD.

Ofreneo, R. E. (2008), Arrested development: multinationals, TRIMs and the Philippines' automotive industry. *Asia Pacific business review*, Vol. 14 No. 1, pp.65-84.

Pemsel, S. Söderlund, J. and Wiewiora, A. (2018), Contextualising capability development: configurations of knowledge governance mechanisms in project-based organizations. *Technology Analysis & Strategic Management*, Vol. 30 No. 10, pp.1226-1245.

Peng, X. Zhang, X. and Luo, Z. (2020), Pythagorean fuzzy MCDM method based on CoCoSo and CRITIC with score function for 5G industry evaluation. *Artificial Intelligence Review*. doi:10.1007/s10462-019-09780-x

Rasiah, R. Kong, X.X. Lin, Y. and Song, J. (2012), Explaining variations in semiconductor catch-up strategies in China, Korea, Malaysia and Taiwan. In *Economic Development as a Learning Process*. Edward Elgar Publishing.

Rebentisch, E.S. and Ferretti, M. (1995), A knowledge asset-based view of technology transfer in international joint ventures. *Journal of Engineering and Technology Management*, Vol. 12 No. 1-2, pp. 1-25.

Ripollés, M. and Blesa, A. (2018), Influence of network ties on inter-firm network management activities. A comparative study of international new ventures and international mature firms. *Canadian Journal of Administrative Sciences/Revue Canadienne des Sciences de l'Administration*, Vol. 35 No. 4, pp.605-619.

Sako, M. (2004), Supplier development at Honda, Nissan and Toyota: comparative case studies of organizational capability enhancement. *Industrial and corporate change*, Vol. 13 No. 2, pp. 281-308.

Sandelowski, M., Barroso, J., & Voils, C. I. (2007). Using qualitative metasummary to synthesize qualitative and quantitative descriptive findings. *Research in nursing & health*, *30*(1), 99-111.

Slaughter, S.A. and Kirsch, L.J. (2006), The effectiveness of knowledge transfer portfolios in software process improvement: A field study. *Information Systems Research*, Vol. 17 No. 3, pp.301-320.

Snider, K.F. and Nissen, M.E. (2003), Beyond the body of knowledge: A knowledge-flow approach to project management theory and practice. *Project Management Journal*, Vol. 34 No. 2, pp.4-12.

Spraggon, M. and Bodolica, V. (2012), A multidimensional taxonomy of intra-firm knowledge transfer processes. *Journal of Business Research*, Vol. 65 No. 9, pp.1273-1282.

Stanujkic, D. Popovic, G. Zavadskas, E.K. Karabasevic, D. and Binkyte-Veliene, A. (2020), Assessment of Progress towards Achieving Sustainable Development Goals of the ""Agenda 2030"" by Using the CoCoSo and the Shannon Entropy Methods: The Case of the EU Countries. *Sustainability*, Vol. 12 No. 14, pp5717-5730.

Taghavifard, M. T., Amoozad Mahdiraji, H., Alibakhshi, A. M., Zavadskas, E. K., & Bausys, R. (2018). An extension of fuzzy SWOT analysis: An application to information technology. *Information*, *9*(3), 46.

Tidd, J. and Bessant, J. R. (2013), Managing innovation: integrating technological, market and organizational change. John Wiley & Sons.

Tjemkes, B. Vos, P. and Burgers, K. (2017), *Strategic alliance management*. Routledge.

Tranfield, D. Denyer, D. and Smart, P. (2003), Towards a methodology for developing evidence-informed management knowledge by means of systematic review. *British journal of management*, Vol. 14 No. 3, pp.207-222.

Ulutaş, A. Karakuş, C.B. and Topal, A. (2020), Location selection for logistics center with fuzzy SWARA and cocoso methods. *Journal of Intelligent & Fuzzy Systems*, (Preprint), pp.1-17.

United Nations Conference on Trade and Development (UNCTAD) (2014). World investment report 2014. Geneva: UNCTAD.

Van Waveren, C. Oerlemans, L. and Pretorius, T. (2017), Refining the classification of knowledge transfer mechanisms for project-to-project knowledge sharing. *South African Journal of Economic and Management Sciences*, Vol. 20 No. 1, pp.1-16.

Wang, Y. Gosling, J. and Naim, M. (2019), Assessing supplier capabilities to exploit building information modelling. *Construction Innovation*, Vol. 19 No. 3, pp.491-510.

Wen, Z. Liao, H. Kazimieras Zavadskas, E. and Al-Barakati, A. (2019), Selection third-party logistics service providers in supply chain finance by a hesitant fuzzy linguistic combined compromise solution method. *Economic research-Ekonomska istraživanja*, Vol. 32 No. 1, pp.4033-4058.

Wen, Z. Liao, H. Mardani, A. and Al-Barakati, A. (2019, August). A Hesitant Fuzzy Linguistic Combined Compromise Solution Method for Multiple Criteria Decision Making. In *International Conference on Management Science and Engineering Management* (pp. 813-821). Springer, Cham.

Wickramasinghe, V. and Widyaratne, R. (2012), Effects of interpersonal trust, team leader support, rewards, and knowledge sharing mechanisms on knowledge sharing in project teams. *Vine*, Vol. 42 No. 2, pp.214-230.

Yazdani, M. Zarate, P. Kazimieras Zavadskas, E. and Turskis, Z. (2019), A combined compromise solution (CoCoSo) method for multi-criteria decision-making problems. *Management Decision*, Vol. 57 No. 9, pp.2501-2519.

Yazdani, M. Wen, Z. Liao, H. Banaitis, A. and Turskis, Z. (2019), A grey combined compromise solution (CoCoSo-G) method for supplier selection in construction management. *Journal of Civil Engineering and Management*, Vol. 25 No. 8, pp.858-874.

Zhang, Y. (2014). Catching-up by Chinese multinational firms using network strategies. In *Successes and challenges of emerging economy multinationals* (pp. 50-102). Palgrave Macmillan UK.

Zolfani, S.H. and Saparauskas, J. (2013), New application of SWARA method in prioritizing sustainability assessment indicators of energy system. *Engineering Economics*, Vol. *24* No. 5, pp.408-414.

Zolfani, S. H. Chatterjee, P. and Yazdani, M. (2019, May), A structured framework for sustainable supplier selection using a combined BWM-CoCoSo model. In *International scientific conference in business, management and economics engineering. Vilnius, Lithuania* (pp. 797-804).