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# A COMPUTERIZED KNOWLEDGE SHARING FRAMEWORK FOR THE SUPPLY CHAIN DEVELOPMENT PHASES

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***Abstract*— although the extant literature has addressed knowledge sharing in various forms, one question remains unresolved, arising from the need for an automated process for sharing knowledge in the Supply Chain (SC). A proposal of a computerized knowledge sharing framework for the SC will impact the SC's performance and productivity. This paper aims to review and analyze the literature on knowledge sharing strategies and then suggest an automated knowledge sharing framework for the SC. First, to develop the proposed framework, we thoroughly reviewed the literature on SC knowledge sharing processes. This review helps us identify how organizations share and manage knowledge during the development process of their SCs. Then, we proposed a computerized knowledge sharing framework for the SC. Accordingly, we suggested that the proposed knowledge sharing framework is unique among the literature strategies, because it automates the knowledge sharing process in the SC, adds value to existing research, and could be adopted by SC decision-making as a knowledge framework to increase the efficiency of sharing, and managing knowledge in the SC phase.**

*Keywords*— **Knowledge Management, Supply Chain, Knowledge Sharing, Knowledge Base**

## I. BACKGROUND OF THE STUDY

Effective knowledge management has been described as a critical factor for organizations seeking to ensure strategic competitive advantages and innovation. In recent years, the importance of Knowledge Management (KM) initiative has witnessed significant interest in the literature aiming to improve the supply chain's (SC)'s performance and productivity [3]. In the SC, knowledge is expected to flow across the SC's tiers and is proposed to be a fundamental factor of the SC's success [4]. Hislop, Bosua [5] added that effective management of SC knowledge would provide a source of competitive advantages and a high level of performance for the SC development process. Moreover, Kim [6] revealed that SC decision-making should put a framework to capture and transfer their stockholders' knowledge before quitting and leaving the SC. Parallel to this, Alfawaire and Atan [7] contended that knowledge held by an organization is the most secure and strategically significant for the organization's success since other organizations would find it difficult to imitate. Furthermore, Santoro, Vrontis [8] stated that the true competitive advantage is built through the ability of SC to apply existing and new knowledge to create new products and processes. In this context, KM process has emerged as a solution for managing and organizing SC's knowledge. Therefore, the SC can earn and benefit from the promise of their created knowledge.

Girard and Girard [9] defined KM as the process of creating, sharing, using and managing knowledge and information of an organization. Baydoun and El-Den [10] described that KM is a process of identifying the knowledge source in the SC, transferring and retaining this knowledge in the SC Knowledge Base (KB), retrieving this knowledge by the SC participants and finally sharing this knowledge in the SC, when needed. Moreover, KM is the process of creating, sharing, using and managing knowledge and information in an organization [11]. It is required for the SC to convert SC's data to knowledge [11]. Furthermore, the purpose of KM is to share perspectives, ideas, experiences and information to ensure that these are available in the right place and at the right time [12, 13].

Baydoun and El-Den [10] conducted an extensive literature review on KM processes and proposed a new KM process for the SC. Interestingly, the knowledge sharing phase was a

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typical phase between all the examined processes; it was mentioned and introduced in almost all the KM processes [10]. However, scholars have been discussing knowledge sharing from a theoretical perspective. There are pages of well-written academic documents [14-16], but unfortunately, very few of which have approached knowledge sharing from a practical perspective and suggested a functional framework for knowledge sharing in SC. A knowledge sharing framework is one of the essential steps for building a comprehensive knowledge sharing policy in the SC [17]. Moreover, the value of knowledge is seen as a strategic resource, and there is a need to move on toward answering the following question: "how to manage and share this knowledge?" [18]. Moreover, Johnson, Marti [19] proposed that a knowledge sharing framework will improve efficiency, innovation, effectiveness, productivity and ultimately improve the quality and outcomes of the SC process. Knowledge hoarding among experts can affect the SC performance [20], while sharing knowledge can benefit the SC by allowing it to stay within its boundaries [21].

Wang and Noe [22] defined sharing knowledge as sharing and providing essential information, thoughts and knowledge to help other participants solve problems and develop ideas. In our case, we define knowledge sharing as a collaborative act of participating in the SC processes, discussions, and sharing experiences and 'know-how' skills among experts and teams of the SC, knowledge can be transferred, stored, and then shared across the different levels of the SC. Accordingly, SC knowledge sharing involves many factors, steps, and activities. Therefore, how do we manage and monitor all these activities/ steps? Therefore, a well-defined knowledge sharing framework for the SC is a must. The following sections thoroughly review the existing knowledge sharing framework and suggest a computerized framework for knowledge sharing in SC.

## II. LITERATURE REVIEW

Organizations have lately started to heavily rely on advanced technologies for the different processes in their SCs to speed up the production and the development processes of their SCs. This created big data, information, and knowledge [23]. The literature discusses two knowledge sharing strategies: Codification framework and Personalisation strategy [24-29]. Codification Framework aims to collect knowledge, store it in databases, and provide the available knowledge in an explicit and codified form. Hence, using explicit knowledge can save time and money [30]. Whereas, Personalization Framework doesn't aim to store knowledge but instead to use information technology to help people communicate their knowledge [30]. The main objective of the personalization framework is to transfer, communicate, and exchange knowledge via knowledge networks such as discussion forums [31]. Moreover, in the Codification strategy, knowledge is carefully codified and stored in databases, where it can be accessed and shared easily by anyone in the company [32]. They explained that the knowledge in the personalization strategy is closely attached to the person who developed it and is shared mainly through direct person-to-person contacts [32]. In this strategy, the primary purpose of a computer system is to help people communicate knowledge rather than to store it. This paper argues with the literature definitions of both strategies. It proposes two new definitions for both strategies: Codification framework is codifying/ transferring knowledge from the SC experts/ groups and storing it into the SC KB. It can be easily accessed and utilized by the SC participants. At the same time, the Personalization framework is the direct discussion/ communication between the experts and groups who participated in the clients' projects and the SC development process. The next section inspects the literature and reviews the most comprehensive knowledge sharing framework for well-known academic researchers.

### *A.* Hansen's Knowledge Sharing Framework –

Hansen, Nohria [2] suggested a framework for knowledge sharing in the SC; Figure 1 illustrates Hansen's knowledge sharing framework. The authors postulated that the rise of networked computers has made it possible to codify, store and share certain kinds of knowledge more quickly and cheaply than ever before. Their study found that the current businesses employ two different knowledge sharing strategies: Codification Framework and Personalization Framework [2]. The authors took their study further and analyzed some businesses' SC; they found that applying one of the strategies mentioned above saved teams from tracking down and talking with the experts who had first developed the projects and formed the knowledge base. The codification of such knowledge saved the SC's teams and clients one full year of work [2].

Hansen, Nohria [2] also added that companies following a codification framework depend on the "economics of reuse" The author explained that once a project process is developed and paid for, it can be used many times over and at a low cost. Because the knowledge is contained in the electronic repositories, it can be employed in many jobs and projects [2]. Despite that the process of the personalization framework is represented by sharing deep knowledge, it is time-consuming, expensive and slow. It cannot be truly systematized, so it cannot be made efficient and productive. The authors provided figure 1 to compare the two strategies.

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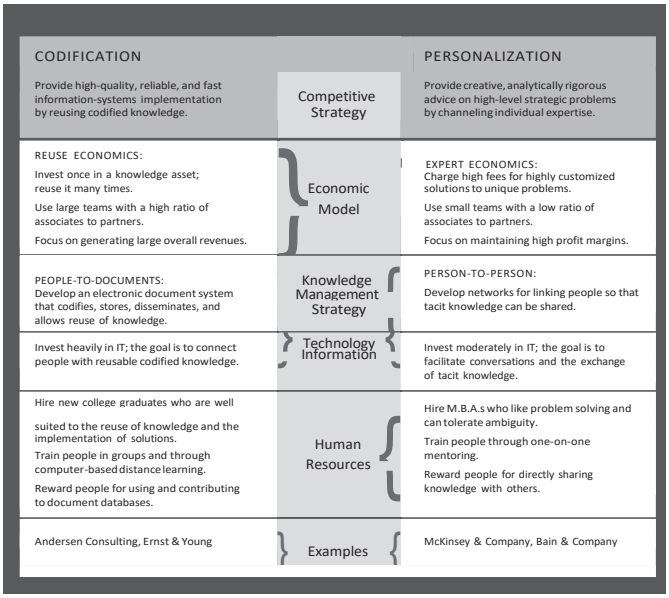


Fig. 1. Hansen Knowledge Sharing framework (Source: [2])

### *B.* Ipe's Knowledge Sharing Framework –

Ipe [33] conducted a review of theory related to knowledge sharing in SC; the author identified four major factors that influence knowledge sharing among individuals: the nature of knowledge, the motivation to share, the opportunities to share and the culture of the work environment.

- Nature of Knowledge: Ipe [33] stated that with the increasing recognition of the importance of knowledge in organizations, different types of knowledge have begun to be valued differently. The two characteristics of the nature of knowledge: tacit and explicit, in addition to the value attributed to knowledge can significantly influence the way knowledge is shared within organizations.
- Motivation to Share: Motivational factors that influence knowledge sharing among individuals can be divided into internal and external ones. Internal factors include the perceived power attached to the knowledge and the reciprocity that results from sharing. External factors include a relationship with the recipient and rewards for sharing [33].
- Opportunities to Share: Opportunities to share knowledge in organizations can be formal and informal. Formal opportunities include training programs, structured work teams, and technology-based systems that facilitate the sharing of knowledge. Informal opportunities include personal relationships and social networks that promote learning and sharing of knowledge [33].
- Culture of the Work Environment: Ipe [33] emphasized that the culture of the work environment significantly influences all the factors mentioned above. Organizational culture is increasingly recognized as a significant barrier to effective knowledge creation, sharing and use [33]. Culture can play an essential role in the knowledge sharing process [34, 35]. Ipe [33] added that these factors: the nature of knowledge, the motivation to share, the opportunities to share, and the culture of the work environment are all interconnected, thus, influencing each other. Figure 2 shows the framework that illustrates Ipe's findings.

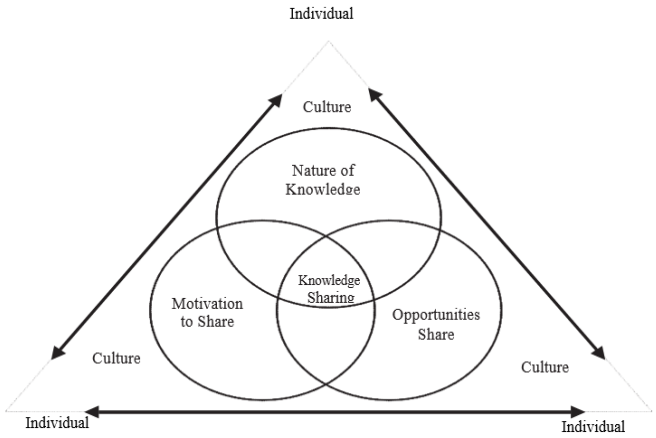


Fig. 2. Knowledge sharing framework (Source: [33])

### *C.* Jones' knowledge sharing Framework –

In their study, Jones and Leonard [1] focused on the process and steps of moving from tacit knowledge to organizational knowledge. They found that one of the most challenging and most exciting steps in the knowledge sharing framework is capturing tacit knowledge and changing it to organizational knowledge. The authors recommended that organizations put this knowledge in some format to utilize it. In other words, the organization must turn tacit knowledge into explicit knowledge. In turn, employees need to take the explicit knowledge and turn it into their knowledge, then create and share additional knowledge. Figure 3 represents Jones' proposed knowledge sharing framework. As noted in Figure 3, Jones's framework includes two organizational and initiative characteristics. These characteristics can affect each step in the knowledge sharing process [1].

Organizational characteristics include an innovative and collaborative culture. The authors stressed that it is essential to consider the organizational characteristics when implementing a technology not explicitly created for the organization. Organizational aspects can support or impede an implementation attempt. Innovation cultures are open to innovations and are willing to give their full attention to help

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the implementation succeeds. At the same time, collaborative culture affects the knowledge sharing implementation [1].

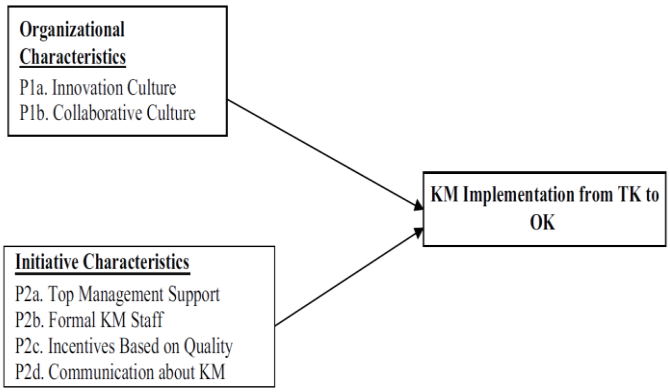


Fig. 3. Jones' knowledge sharing framework (Source: [1])

## III. The Proposed Knowledge Sharing Framework

It is evident from the above literature that there are two knowledge sharing strategies, namely, codification framework and personalization framework. [24, 36, 37] argued that a new combination strategy between the two approaches will increase and promote both strategies' benefits. They recommended integrating both the personalization and codification strategies to benefit knowledge sharing. The authors added that both personalization and codification strategies have positive and negative implications, and they are alone insufficient to ensure knowledge sharing in the organizations [24, 36, 37]. Moreover, due to the complicated human involvements in the knowledge sharing processes, there is an obvious need to systemize this process in SC; a computer system can then perform and execute the knowledge sharing initiatives in SC. As a result, the created knowledge is systematically captured and shared. The systematic knowledge sharing process ensures the protection of the SC knowledge and minimizes human errors. [38, 39] reported that organizations invest heavily in electronic systems, hoping to increase their ability to manage and share the vast array of explicit knowledge.

Interestingly, this paper proposes a new knowledge sharing framework for the SC. It is a combination/ integration between the two above literature strategies: "Codification and Personalisation"; it takes advantage of the positive features of both strategies. It is a system-based framework that ensures and performs all the knowledge sharing implementation's requirements. Figure 4 illustrates the paper's proposed SC knowledge sharing framework.

The paper's knowledge sharing framework proposes a new computer-based knowledge sharing system to facilitate knowledge sharing among the SC. The proposed computer system initiates and creates a new workspace for every new SC project. The proposed system provides all the necessary tools to facilitate knowledge sharing in the SC. The project participants must use this knowledge sharing system and its provided tools to communicate, discuss tasks, exchange files and explain the projects logs and tasks. As shown in figure 4, the paper proposed a knowledge sharing system, which encompasses the following tools: Workspace, Chat Room, Search Engine, Project tasks' explanation & discussion, Files Attachment, and SC KB.

- Workspace: A computer system interface contains all the tools facilitating knowledge sharing among the SC project participants. Every new SC project is assigned to a workspace. Then, the SC participants use this workspace to communicate and share knowledge. After completing the project, the system captures an image of this workspace with all its entries; including the chat rooms' entries and the disclosed knowledge. Finally, it retains the image in the SC KB for future use.
- Chat Room is a facility that provides a live chat among the SC project participants. All the communication about the project must occur via the "Chat Room" tool. To put it simply, let's say that an SC expert (1) has a question regarding a specific task or process; they use the "Chat Room" tool to post their question. Then, one of his project team members (SC expert (2)) answers their question by providing a problem-solving procedure and a detailed explanation of the solution. It is similar to Microsoft messenger; the experts must discuss, ask and share perspectives through the "Chat Room" tool. Upon project completion, the contents of the "Chat Room" and its entries are retained in the SC KB for future use. Figure 4 represents the "Chat Room" provided in the project's workspace.
- Project tasks' explanation is a textbox where the SC project participants must write a description about each project task.
- Search Engine provides the SC project participants with the ability to search and retrieve stored knowledge from the SC KB. In other words, the SC project participants can utilize this tool to search and retrieve the previously captured and retained knowledge in the SC KB.
- Files Attachment is a tool that provides the SC project participants with the ability to attach, share and exchange files among them. The shared files represent all the possible SC projects files; including manuals, documents, objects, etc.
- SC KB is a storage knowledge base that holds all the previous SC project's data. Upon SC project completion, all the project entries, including the contents of the system workspace, must be automatically transferred and retained in the SC KB, where SC participants can easily access.

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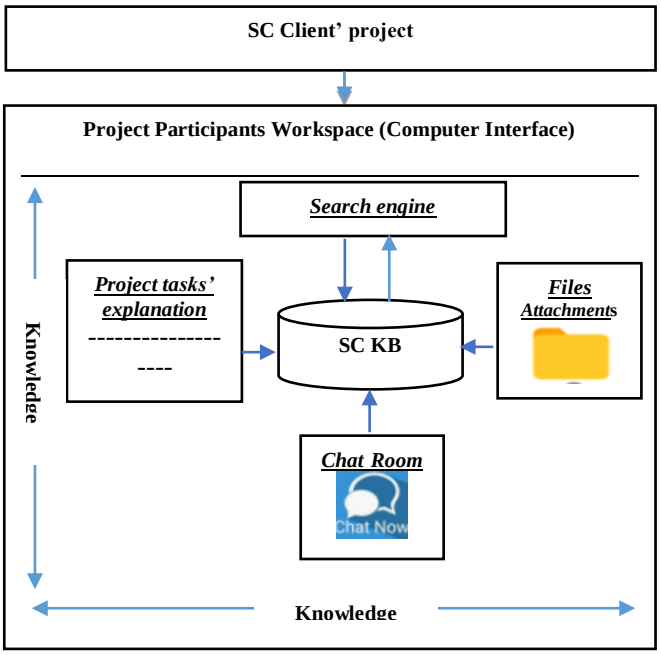


Fig. 4. Computerized Knowledge Sharing framework for SC

### *A.* Prior requirements of SC knowledge sharing application –

Some critical knowledge sharing factors must be considered before applying the paper suggested Framework: SC culture and SC top management. It is believed that without satisfying these factors, the application of KM Framework in SC will not be practical, and the overall proposed KM Framework would be inefficient [40-42]. Thus, without the right culture which emphasizes knowledge sharing and encourages experts and groups to participate in knowledge discussions, all the SC KM efforts and best optimal KM Framework would be invalid and considered a waste of resources and time. In addition, without SC's top management support, the SC experts would not take sharing knowledge seriously and would not consider it a priority task. Therefore, these two factors must be highly regarded and satisfied before applying an SC knowledge sharing framework.

### *B.* The benefits of SC KM Framework application –

After applying the SC knowledge sharing framework to the SC operations, an increase/ improvement in SC's performance, speed and productivity are expected. An optimal KM Framework can cultivate and maximize corporate profit and performance [43, 44]. Having the knowledge centralized in the SC KB, the experts/ groups can easily access, search for and retrieve this knowledge when needed. Thus, saving a considerable time of talking and contacting the experts who were initially involved in the development while creating that knowledge (in most cases, these experts may have left the SC and are not part of SC operations anymore). In this regard, Hansen, Nohria [32] had earlier posited that knowledge reuse saves work, reduces communications costs and allows a company to take on more projects. The authors took their study further and applied their developed knowledge sharing framework to some businesses. They stated that some companies could grow at 20% per year due to the KM Framework application [32]. Moreover, Meehan and Richardson [45] stated that in the process of SC, knowledge sharing helps to avoid the same mistakes, reduces dependency on a few employees who own critical knowledge, increases integration of individual competencies (including knowledge, experiences, and skills) and improves decision making at the organizational level. Slaughter and Kirsch [46] declared that the improvement of the SC project process involves intensive teamwork and produces significant amounts of knowledge, hence, making sharing of knowledge among individuals effective, essential and meaningful.

## IV. CONCLUSION

Based on a detailed analysis of the existing literature, the research introduces a computerized knowledge sharing framework that depicts the application of knowledge sharing in SC. Research studies suggesting the SC's knowledge sharing framework are still limited and almost nonexistent in the literature. It is evident from the literature that an automated knowledge sharing framework positively and effectively influences SC productivity, performance and speed. The findings of this research could be used by SCs' management to facilitate SCs knowledge sharing processes and could be also used by academics for further investigations. We firmly believe that the study's proposed framework is an effective and efficient framework that must be adapted within the SC development process.

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