

Knowledge management according to the SECI model to achieve technological development «Case study: Small and medium enterprise »

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Abstract:

The topic of knowledge management has gained great importance for organizations of all kinds, as they rely heavily on the knowledge of their human resource in achieving their goals and ensuring their continuity, so this resource must be dealt with according to a strategic perspective, and in light of what our study addressed concepts about knowledge and its management as a strategic resource for organizations, and as a result of this importance, it addressed the most prominent model, the SECI model presented by researchers Nonaka and Takeuchi as it combines a wide range of knowledge processes that are considered one of the basic activities of knowledge management. This study aimed at managing knowledge according to the SECI model leads to technological development in small and medium-sized enterprises, relying on the descriptive-analytical approach as a methodology for the study.

The results of the study found that the level of knowledge management according to the SECI model is moderate in the studied organizations, which allowed us to propose applicable recommendations for the studied organizations.

Keywords: Knowledge, knowledge management, SECI model, technological development.

Jel Classification Codes: D38, M19, O30.

1. INTRODUCTION.

Despite an abundant literature over the last two decades on the importance and challenges of the knowledge economy in the countries of the South (Dahlman, 2005, & Djeflat, 2016, p. 3), the issue of knowledge management remains little explored (Andreeva & Kianto, 2012, p.1). Knowledge management is therefore a complex area of research, not least because knowledge, as an object of study, is indirectly linked to the individual and his or her professional practices. Considering knowledge as an invaluable resource for companies ultimately leads us to question the relationship between the individual and the company. At the root of this is the question of explicit knowledge and tacit knowledge as intangible factors, but how essential to the knowledge management and innovation in the context of companies in developing countries (Djeflat, 2006, p.4; Datoussaid & Hamadi, 2016, p.5), are crucial. The tacit knowledge originally stimulated by Polanyi's work was amplified at the macro-economic level by proponents of the systemic vision of technological change (Nelson & Winter, 1982; Lundvall, 1996; Johnson et al, 2002) and then taken up at the micro-economic level by the essential model of Nonaka and Takeuchi.

This notion is widely used in the evolutionary approach (Helfat, 1994). In this new approach, there is an original Japanese culture in terms of knowledge management, stemming from the situation of uncertainty in which this country has been immersed geographically, historically and economically for several centuries. It is on this basis that Japanese companies have been able to develop a dynamic of knowledge creation that constitutes a veritable school of knowledge management. This led Nonaka to question the nature of the knowledge circulating in projects carried out by Japanese companies. He pointed out that the East focuses more on tacit knowledge, whereas the West tends to be more concerned with explicit knowledge.

In the case of Algeria, although explicit knowledge is at a low level, it has achieved notable results over two decades (1970, 1980 et 1990), while tacit knowledge is now a capital to be mobilised for innovation by industrial SMEs (Datoussaid, 2019, p.7) (Datoussaid, 2020, p.9). According to (Djeflat, 2022, p.9) (Djeflat, 2022, p.69), in addition to their conceptual limitations, the traditional approaches to development spurred on by the work of Robert Solow (1956) have neglected the crucial elements required for 'endogenous, development'. Moreover, technical progress remained exogenous throughout the development trajectory, in the face of the demands of urgent development and an angelic vision of 'catching up'. By contrast, more recent theories, such as those of (Romer, 1993, p.19), determine technological progress endogenously.

In this new context, since the modern conceptualization of knowledge management (KM) in the mid-1990s, with the seminal works of Nonaka and Takeuchi (1995), KM has been regarded as a set of methods for gathering, combining, and transferring knowledge assets, with a focus on creating new knowledge. This shift emphasizes the importance of innovation as an inevitable outcome for organizations leveraging KM. As such, KM has become a critical framework for driving technological progress and innovation within organizations. In a rapidly evolving technological environment, small and medium-sized enterprises (SMEs) operating in sectors dominated by innovation, artificial intelligence, and

digital transformation face the challenge of aligning with these technological shifts. The fate of SMEs is intrinsically linked to their ability to adapt to and leverage these advancements. The concept of knowledge management, particularly SECI model, plays a pivotal role in shaping how these organizations respond to technological change and enhance their innovative capabilities.

Our study examines the application of SECI model within SMEs in Sidi Belabbas municipality, aiming to explore whether it can be regarded as a suitable framework for fostering technological development. By analyzing a sample of SMEs, the study seeks to answer the question: Can the SECI model be considered as the most compatible approach for Algerian SMEs to achieve technological progress in a highly innovation-intensive environment?

2. Literature Review.

2.1. Knowledge as intangible capital in the technological environment.

The transition from a traditional manufacturing-based economy to a knowledge- and service-based economy over recent decades resulted in a considerable rise in intangible capital (Foray, 2009, p. 15; Labiad, & Datoussaid, 2021, p. 5), most of which is not reported on companies' balance sheets (Huseyin et al. 2024, p.7). The factors of growth, productivity, and competitiveness no longer reside in physical and financial capital but rather in intangible assets, where knowledge plays an indispensable role (Djeflat, 2022, p.7) (Datoussaid, 2015, p. 4).

Knowledge, as one of the inputs of intangible capital, has become a crucial indicator in measuring knowledge-based economies. The global reports on knowledge and innovation consistently demonstrate that both the most advanced countries and the emerging nations hold significant rankings in the realm of knowledge (Datoussaid, & Labiad, 2022, p. 103). Particularly in today's era of technology and the growing emphasis on artificial intelligence as an emerging field, new knowledge generated from AI is emerging as a critical output. This necessitates that institutions keep pace with this new technological landscape (Farkhondeh, H, Mehdi, F.K, 2011, p.3).

The reports on global knowledge and innovation underscore the prominent positions of both the leading developed countries and the secondary emerging nations in the domain of knowledge. Especially in our current age of technology, where the focus is shifting towards the applications of artificial intelligence, new knowledge derived from AI is becoming a vital output. This development compels organizations to align themselves with this evolving technological frontier (Karl, 2001, p.3).

It is noteworthy that knowledge is a crucial component of intangible capital, which is further divided into human capital, structural capital, and relational capital. Human capital encompasses knowledge as a significant part of its composition, reflecting the skills and expertise of individuals, abilities, behaviors. Structural capital includes research and development activities, which are essential for innovation and technological advancement, organizational culture. Relational capital, on the other hand, pertains to the networks and

relationships that organizations maintain, which are vital for collaboration and knowledge sharing, customer relationship, customer-based brand equity and relation to society (Labiad & Datoussaid, 2021, p. 224).

2.2. Knowledge Management in SMEs.

Since the inception of the concept of KM, it has been extensively debated and adopted by large organizations. Nonetheless, there is a noticeable inclination to prioritize large businesses, overlooking SMEs, despite the critical role KM plays in enhancing SME performance and their ongoing substantial economic contributions. Studies conducted by (Massaro & et al, 2016, p.258) and (Cerchione & et al., 2016, p.170) emphasize that the implementation of KM in SMEs presents challenges and necessitates long-term research and organizational efforts (Xingyu & et al. 2022, p.1051).

In its most general sense, knowledge management (KM) is defined by Pritchard (2010) as a management approach aimed at fostering a competitive advantage through unconventional means. This concept is particularly relevant for contemporary enterprises, including non-profit organizations. Prominent advocates of KM, such as T.H. Davenport and S.C. Völpel, emphasize its critical role in enhancing knowledge creation methods, followed by its effective dissemination and utilization. Additionally, P. Murray and A. Myers propose a definition of KM as a collection of processes facilitating the creation, dissemination, and use of knowledge to achieve organizational objectives.

For instance, (Susanne.D, Ingi.R.E,&Samuel.F,2023, p.36) indicate that numerous SMEs lack a strategic approach to KM, often addressing it at an operational level (Durst & Edvardsson, 2012, p.880 ; Massaro & et al., 2016, p.258). Given that KM is frequently discussed through various KM processes (KMPs)—including knowledge identification, creation, storage, dissemination, and application—as proposed by Alavi and Leidner (2001) and Yew Wong and Aspinwall (2004), Durst and Edvardsson (2012) integrated these processes with typical SME attributes such as resource constraints, flexibility, small scale, informality, and lower turnover rates to elucidate the potential impact of these KMPs on SME viability.

Implementing knowledge management in SMEs is a complex endeavor, influenced by the interplay of IT processes, human resources, potential modifications to organizational culture, and, depending on the business profile, other pertinent factors. Notably, the literature on knowledge management often overlooks the intricacies of implementation. Consequently, the deployment of a knowledge management system in SMEs remains a challenging and under-explored area.

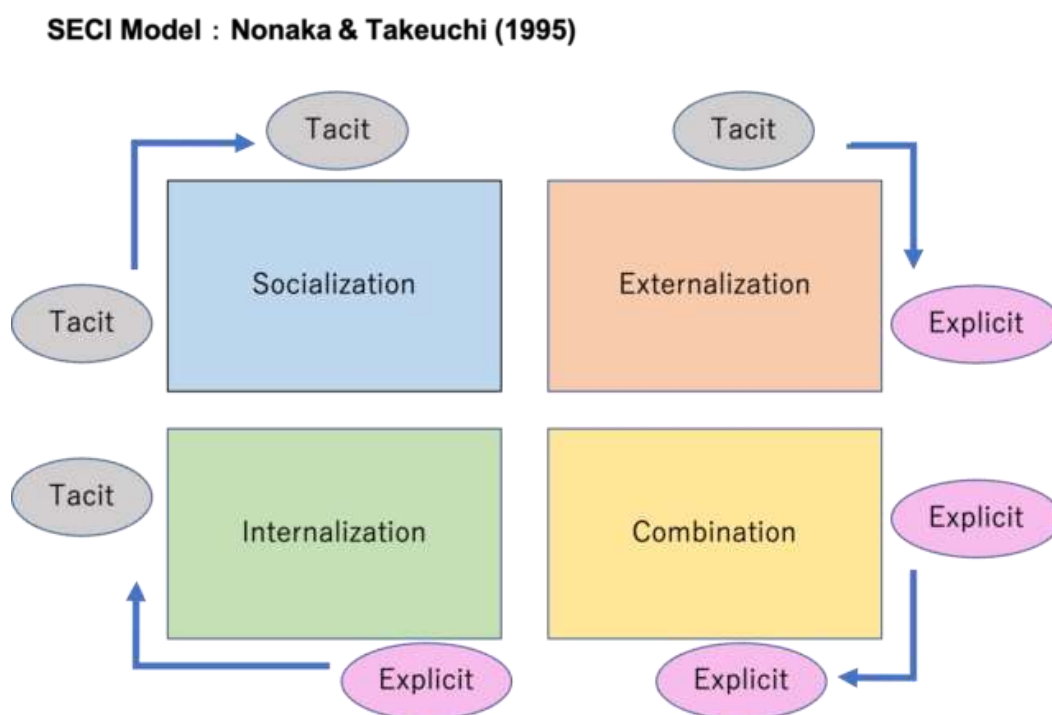
2.3. SECI model by Nonaka and Takeuchi: dominant model.

Nonaka and Takeuchi are considered the first to link the success of Japanese companies to their ability to create new knowledge and utilize it to produce successful products and technologies. Nonaka concluded that knowledge is the fundamental unit of analysis to explain the behavior of Japanese companies and to interpret the reasons for their success. It appears that the ability to generate and disseminate knowledge is essential for the success of any

innovative project. Consequently, the theory of knowledge creation in organizations emerged, developed by both Nonaka and Takeuchi, which they presented in their book 'The Knowledge-Creating Company' in 1995. Through this book, they introduced the SECI model for knowledge formation (Socialization, Externalization, Combination, Internalization).

The model posits that individuals generate their knowledge through the interaction between explicit and tacit knowledge (Djeflat, 2024, p56). Knowledge undergoes a process of qualitative and quantitative expansion through four stages, starting with socialization, where tacit knowledge is created through the exchange of experiences, ideas, and skills among individuals through direct contact and shared experiences. This is followed by externalization, where tacit knowledge is articulated and transformed into explicit knowledge, crystallizing it into a form that is easily shared with others. The combination stage involves transforming explicit knowledge into a more complex and systematic form. Next comes internalization, where individuals internalize explicit knowledge, converting it into tacit knowledge through practice or learning by doing, facilitated by self-directed learning, making explicit knowledge an integral part of the individual's knowledge. Figure (01) illustrates the knowledge creation cycle (SECI).

Fig.1.The SECI Knowledge Creation Cycle Model



Source: Nonaka, I., Toyama, R. and Konno, N, 2000, pp 34 35

According Cesar (2017) the dynamic theory of knowledge creation, formulated by Nonaka and Takeuchi (1995) and commonly referred to as the SECI model, postulates that knowledge is generated through the creative interplay between tacit and explicit know-how, resulting in a dynamic sequence of activities that facilitate the creation, transfer, and application of knowledge. These activities encompass the socialization of knowledge (from tacit to tacit), externalization (from tacit to explicit), combination (from explicit to explicit,

enhancing existing knowledge assets), and internalization (from explicit to tacit, enabling learning from explicit knowledge assets and subsequent recall and application of new insights). These activities recur at escalating levels of complexity, driving knowledge expansion through a knowledge spiral of Nonaka & Takeuchi (1995). Figure 1 depicts the SECI model, with tacit knowledge assets on the left, explicit knowledge assets on the right, and the four knowledge creation activities allocated to distinct quadrants. As a firm engages in knowledge creation, it cycles through these four quadrants (typically beginning with socialization), progressively generating more complex knowledge with each cycle (Natek, S., & Zwillig, M, 2016, p.1128).

Numerous studies have highlighted limitations in the SECI model. (Li & Gao, 2003, p.7) critically examined the SECI model, asserting that its validity was primarily demonstrated for Japanese manufacturing companies at the time and may not be universally applicable. Powell, Thomas, and McGee (2007) generally critique the SECI model, arguing that the fundamental assumption of seamless conversion between tacit and explicit knowledge, upon which these models are built, is flawed. Richter (2011) criticized the SECI model for its lack of empirical foundation (Nonaka, Toyama., & Hirata, T. 2008, p.25).

A modified version of the SECI model is applicable to SMEs (Desouza & Awazu, 2006, p.35), characterized by the dominance of the socialization phase, where other stages are subdued. They assert that socialization serves as the primary conduit for knowledge transfer from the owner to employees and among employees, with informal and formal socialization methods occurring naturally throughout the day being the key drivers of knowledge exchanges. Nonetheless, this perspective appears to diminish the significance of the reverse process, namely internalization (Cesar.B, Fazel.K, Michael.R.B, & Shiromani.N, 2017, p.166). While socialization facilitates the externalization of tacit knowledge from owners to employees, knowledge creation also occurs through the internalization of externalized knowledge by employees via interactions and apprenticeships, emphasizing the left quadrants of Nonaka's SECI model. (Nonaka, I., Toyama, R., & Hirata, T. 2008, p.46). Despite criticisms, the SECI model is highly respected in academic and practitioner communities (Cesar.B, Fazel.K, Michael.R.B, & Shiromani.N, 2017, p.167).

3. Methodology.

In our study, we conducted an analysis of a random sample consisting of 03 small and medium-sized enterprises (SMEs) in the municipality of Sidi Bel Abbes. Questionnaires were distributed and analyzed using the SPSS statistical tool. A five-point **Likert** scale was used, and since we chose three levels of answers (weak, medium, and strong), we determined the length of the cells of the scale as shown in the **table 1**.

Table 1.Level Limits Scale

Level (Weak)	Level (Average)	Level (Strong)
1 to 2.33	2.34 to 3.67	3.68 to 5

The internal consistency validity of the questionnaire items was tested as shown in the **table 2**.

Table 2.Internal consistency of the axis phrases

N ^o	Phrases related to the SECI model of knowledge management		Consistency with the axis
1	tacit knowledge to tacit knowledge	There is socialization that allows the exchange of ideas among workers	0,983**
2		It integrates previous and current knowledge and leads to new knowledge.	0,92**
3	tacit knowledge to explicit knowledge	You use the knowledge stored in your minds and apply it in your field of work	0,979**
4		Your organization allows for the sharing and application of knowledge and contributes to research and development	0,901**
5	explicit knowledge to explicit knowledge	Your organization has information storage capabilities through centralized computers and others	0,868**
6		You are able to combine newly acquired knowledge and reach creative insights.	0,953**
7	explicit knowledge to tacit knowledge	While receiving knowledge, new insights are generated in your minds	0,963**

$\alpha=0.01$

Source: Prepared by the researchers based on SPSS outputs.

The results of the **table 2** above indicate that the correlation is strong, and therefore the axis statements can be judged to be characterized by internal consistency, and thus we consider the axis of the SECI model of knowledge management to be true to what it was designed to measure.

4. Results and Discussion.

We will review the data and results of the field study in the form of a table and explain it graphically after processing it using SPSS, and then we will analyze it.

4.1. Results

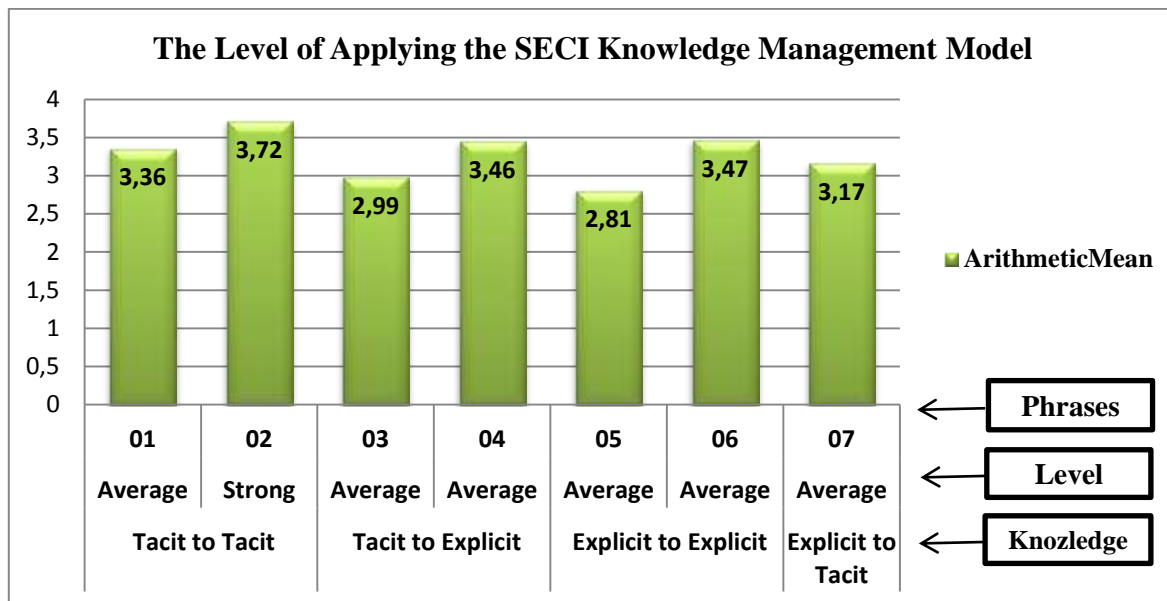
The focus is on statements specific to the SECI model of knowledge management. Statement 01 and 02 from tacit knowledge to tacit knowledge, statement 03 and 04 from tacit knowledge to explicit knowledge, statement 05 and 06 from explicit knowledge to explicit knowledge, statement 07 from explicit knowledge to tacit knowledge, where we determined the level of its statements as shown in Table 3.

Table 3. The Level of Applying the SECI Knowledge Management Model in the Institutions under Study

N	The phrases of the SECI model for knowledge management	Strongly agree (%)	Agree (%)	Slightly agree (%)	Disagree (%)	Strongly disagree (%)	Arithmetic Mean	Standard Deviation	Level
01	There is a socialization process that allows for the exchange of ideas among workers	19	31	25	17	08	3,36	1,20	Average
02	It integrates previous and current knowledge to arrive at new knowledge	29	29	30	09	03	3,72	1,07	Strong
03	You use the knowledge stored in your minds and apply it in your work field	19	20	21	21	19	2,99	1,39	Average
04	Your organization allows the sharing and application of knowledge and contributes to research and development	22	39	15	11	13	3,46	1,30	Average
05	Your organization has storage capabilities for information, such as central computers and others	12	18	29	21	20	2,81	1,28	Average
06	You are able to integrate newly acquired knowledge and generate creative knowledge	24	30	23	15	08	3,47	1,23	Average
07	While receiving knowledge, new knowledge is generated in your minds	28	23	07	22	20	3,17	1,53	Average
TOTAL							3.28	1.32	Average

Source: Prepared by the researchers based on SPSS outputs.

Fig.2.The Level of Applying the SECI Knowledge Management Model



Source: Prepared by the researchers based on Table 3 & Excel.

After obtaining the survey results and presenting them in table form (Table 03) and graphically (Figure 02), we proceed with their analysis. At the level of the axis statements, we find variation in the mean value of each statement compared to the hypothetical and general mean of the axis. We observe that statements (1, 2, 4, 6), with mean values ranging from 3.36 to 3.72, are higher than the overall mean of 3.28, thus contributing to the increase in the general mean of the axis. Additionally, statement (2: "It integrates previous and current knowledge and reaches new knowledge") recorded the highest mean, indicating that knowledge generation occurs within the studied institutions.

Conversely, statements (3, 5, 7), with mean values ranging from 2.81 to 3.17, are lower than the general mean of 3.28, contributing to the decrease in the general mean of the axis. Statement (5: "Your institution has information storage capabilities, such as central computers and others") recorded the lowest mean, suggesting that the training and development of human resources in these institutions are somewhat deficient, particularly in providing adequate means for accessing published documents and enabling their simultaneous use.

From our analysis, we conclude that the level of application of the SECI knowledge management model in the studied institutions is average, with an overall mean of 3.28. This is because the mean values for the axis statements range between 2.81 and 3.72, most of them are considered average. Therefore, the level of knowledge management according to the SECI model is moderate in the studied institutions. This result contrasts with findings from studies that indicate higher adoption of the SECI model, especially in Japanese institutions. This discrepancy can be attributed to the medium level of attention these institutions give to knowledge management processes, due to obstacles such as the lack of an adequate work environment that encourages teamwork and gives employees more freedom to act and initiate, as well as the lack of advanced technology in knowledge management based on the SECI model.

4.2. Discussion and recommendations.

4.2.1 From tacit knowledge to tacit knowledge: The results indicate that socialization, which allows the exchange of ideas among workers, is moderate, while the level of integration between previous and current knowledge to reach new knowledge is strong among the workers. This suggests the presence of considerable tacit knowledge among the employees of the studied organizations.

From the two statements (1 and 2), there is above-average socialization among the workers, but it is insufficient. This is due to the fact that the organizations under study do not sufficiently encourage their outstanding employees to share their information and knowledge with their colleagues, due to the weak work environment that does not promote teamwork (Djefflat et al, 2020, p. 7). This results in the loss of the organizations' intellectual capital. A study by Datoussaid (2019) confirmed that, despite the significant importance of tacit knowledge as an internal strategic resource for organizations, there is a continued loss of intellectual capital in small and medium-sized enterprises (Datoussaid, 2019, p.7). This situation suggests that small and medium-sized enterprises (SMEs) have yet to fully recognize the importance of tacit knowledge as an intangible asset. As a result, these institutions face challenges and often fail due to the loss of valuable knowledge and integration of tacit knowledge (Datoussaid & et al, 2018, p 12). As emphasized by the same author (2019), the failure to effectively manage and leverage tacit knowledge can significantly hinder the growth and innovation capabilities of SMEs (Datoussaid, 2019, p.7), ultimately impacting their sustainability and competitive advantage (Hugo, 2022, p.65).

4.2.2 From tacit knowledge to explicit knowledge: Based on statements 3 and 4, which have mean values of (2.99 and 3.46), it is evident that the use of workers' knowledge stored in their minds, which they apply in their work within the organization, is moderate. Additionally, the level at which the organization enables workers to share and apply knowledge, and contribute to research and development, is also moderate. Therefore, from statements 3 and 4, we conclude that the level of knowledge externalization among the workers in the organizations under study is moderate. This result can be explained by the fact that the organizations do not provide a dialogue environment that facilitates the sharing of knowledge, skills, and experiences among workers. This has reduced the possibility of showcasing their tacit knowledge and presenting creative ideas that would help the organization improve and grow technologically.

In the field of knowledge management, transforming tacit knowledge into explicit knowledge is essential, as it serves as a prerequisite for the knowledge amplification process. This process allows knowledge to become integrated into an organization's knowledge network (Richard & et al., 2001, p.107; Josephine, 2023, p.738).

4.2.3 From explicit knowledge to explicit knowledge: Based on statements 5 and 6, which have mean values of (2.81 and 3.47), it is clear that the organizations under study have moderate capabilities for storing information and knowledge through information and communication technology tools such as centralized computers and others. This affects the ability of workers to combine new acquired knowledge and reach creative insights. Therefore, from statements 5 and 6, we conclude that the level of knowledge combination among the

workers in the organizations under study is moderate. This result can be explained by the fact that the workers in these organizations do not fully benefit from research and published reports due to the suboptimal use of information and communication technology tools, such as specialized computers for storing and disseminating information. This limits the development of both the organizations' and their workers' knowledge.

The transformation of explicit knowledge into new forms of explicit knowledge is crucial for small and medium-sized enterprises (SMEs) operating in a technological environment. This process involves refining, reorganizing, and integrating existing knowledge to create innovative solutions and actionable insights. In a fast-paced digital landscape, SMEs can leverage technological tools to extract valuable information, adapt it to their unique needs, and reframe it in ways that enhance their operational efficiency and market responsiveness. This continuous cycle of explicit knowledge transformation enables SMEs to remain agile, competitive, and forward-thinking (Amitabh & et al., 2021, p.1874).

4.2.4 From explicit knowledge to tacit knowledge: Based on statement 7, with a mean value of (3.17), it is clear that the level of tacit knowledge generation among the workers in the organizations under study during the reception of explicit knowledge is moderate. This affects the sustainability of tacit knowledge, which is considered a competitive advantage for the organizations under study and allows for their technological continuity and growth. Therefore, from statement 7, we conclude that the level of knowledge internalization among the workers in the organizations under study is moderate. This result can be explained by the fact that the management in these organizations does not sufficiently encourage continuous learning among workers to increase their tacit knowledge and experience, which helps the organization to persist and remain competitive. The studies by Aimad Datoussaid (2019; 2020) emphasized that to develop tacit knowledge within an organization, it is essential to leverage professional experience, learn through practice and routine, in addition to the need to adopt a knowledge management model that allows the utilization of accumulated knowledge to achieve creativity and innovation, and thus foster technological growth.

In the realm of technology and artificial intelligence, explicit knowledge has become indispensable for small and medium-sized enterprises (SMEs). AI-generated outputs serve as a rich source of explicit knowledge that can be harnessed to enhance decision-making, streamline processes, and foster innovation. By effectively integrating these outputs into organizational practices, SMEs can transform explicit knowledge into tacit knowledge, embedding it within their workflows and expertise, thereby building a competitive edge in a rapidly evolving digital landscape (Augustina&et al., 2016, p.2).

5. CONCLUSION.

In conclusion, the findings regarding the application of the SECI model in small and medium-sized enterprises (SMEs) reveal satisfactory but generally moderate results. The study highlights the presence of tacit knowledge within these organizations, though it remains underutilized due to weak working environments that fail to foster the level of socialization required for effective knowledge sharing. Additionally, SMEs face significant challenges in converting tacit knowledge into explicit knowledge, reflecting gaps in their knowledge management practices. The study also underscores that SMEs are not adequately keeping

pace with technological advancements. This is evident in their limited use of modern technological tools and methods, particularly at a time when the world is experiencing the transformative era of artificial intelligence. Such gaps hinder SMEs' ability to leverage technological innovation for enhanced knowledge processes and organizational growth.

As a result, investing in intangible assets has become an imperative for SMEs. Prioritizing areas such as knowledge management, innovation, research and development, institutional values, and external relations can significantly enhance the applicability of the SECI model within SMEs. Strengthening these dimensions not only positions SMEs to better embrace the demands of the AI-driven era but also fosters a culture of continuous improvement and sustained competitiveness.

From the results obtained, some advice can be given, namely:

- Encouraging communication between workers and the organization, and urging them to share knowledge among themselves to facilitate their chaos at all levels.
- Giving the opportunity to take initiative and present effective ideas that encourage the creation of new knowledge, such as group brainstorming meetings.
- Adapting the incentive system on the basis of encouraging new innovations.
- Carrying out new courses capable of discovering innovations and appropriate solutions at the appropriate time and place.
- The use of media, technology and communication to store diverse knowledge, such as the use of automated media devices, the Internet, and artificial intelligence systems.

Finally, the institutions under study must make effective use of their human resources, especially those that possess creative thinking as intangible capital, with the aim of achieving creativity and innovation and thus gaining a competitive advantage that ensures their survival and continuity.

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