

The Application of Knowledge Management (KM) by Small and Medium-Sized Enterprises (SME) in Manufacturing Industry

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Abstract: To accelerate the digital transformation of small and medium-sized manufacturing enterprises (SMEs), this study delves into the primary challenges encountered in adopting knowledge management (KM) within these organizations and identifies the essential methods for successful implementation. The objective is to provide practical recommendations for the effective adoption of KM. This research suggests that enterprises should promote knowledge management through three key approaches: enhancing employees' cognitive understanding, standardizing knowledge systems, and tailoring business scenarios to meet diverse needs. These findings offer valuable insights into the digital transformation of SMEs in the manufacturing sector, ultimately helping these businesses to remain competitive and innovative in a rapidly changing market. By addressing the specific needs and challenges faced by SMEs, this study aims to contribute to a more comprehensive understanding of how knowledge management can be leveraged to drive digital transformation and improve overall business performance.

Keywords: Knowledge management (KM); Small and medium-sized enterprises (SME); Manufacturing industry

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1. Introduction

Knowledge is not only a vital asset for individuals but also for organizations. It is a key resource for maintaining continuous competitiveness and fostering innovation within enterprises. Knowledge management (KM) is a systematic approach aimed at capturing, developing, sharing, and effectively utilizing knowledge and information within an organization. Its scope includes knowledge acquisition, storage, sharing, application, innovation, evaluation, and cultural development. Since its inception in the 1980s, KM has evolved from simple document management and information storage to digitalization and intelligence, increasing its significance within enterprises^[1]. According to Soumyaja and Sowmya, in the dynamic and rapidly changing modern business environment, the adoption of KM is increasingly important for organizations striving to maintain competitiveness and foster innovation^[2]. Furthermore, KM plays a crucial role in optimizing organizational and individual knowledge assets, especially amid constantly changing competitive dynamics. Adoption of KM

can stimulate innovation, thereby boosting performance and enhancing the competitive position of small and medium-sized enterprises (SMEs) ^[3]. Pinho *et al.* suggest that managerial cognition and behavioral patterns significantly impact KM, indicating that an organization's behavioral cognition largely determines the level of KM ^[4]. This study discusses how to implement and advance KM in manufacturing SMEs, providing a crucial foundation for promoting digitalization and achieving internal networking within these enterprises. It opens new avenues for research management in manufacturing SMEs.

2. Challenges in adopting KM in SMEs within the manufacturing industry

Currently, SMEs in the manufacturing sector are still in the exploratory stage regarding KM compared to other enterprises. The main challenges include difficulties in knowledge acquisition, information overload, complexities in mining and utilizing tacit knowledge, weak alignment between knowledge and business operations, diverse types of knowledge, and challenges in standardizing data versions.

2.1. Difficulty in knowledge acquisition

SMEs in the manufacturing industry often adopt a familial and flat management style, characterized by traditional practices and an imperfect management system ^[5]. Throughout their development, these enterprises accumulate extensive experience across various business stages, including marketing, Research and Development (R&D), production, project management, and post-sales support. This process results in a vast amount of both structured and unstructured knowledge resources. Structured knowledge originates from production testing, monitoring processes, financial operations, and Product Life-Cycle Management (PLM) activities. In contrast, unstructured knowledge typically resides in personal folders or independent business systems, encompassing drawings, industry standards, technical specifications, and patent papers.

Due to business segmentation, these knowledge sources are often dispersed among different personnel. Employees tend to focus only on their specific job responsibilities, lacking a comprehensive understanding of other business aspects within a project. This compartmentalization means that even experienced employees may struggle to adapt quickly to new roles after changing positions, due to a lack of knowledge about their new responsibilities. This situation significantly reduces overall work efficiency and hinders the enterprise's ability to respond agilely to changes ^[6].

Moreover, the accumulation of extensive experience and knowledge across various business stages creates a complex knowledge landscape. Without a standardized and integrated knowledge management system, SMEs face difficulties in effectively utilizing these resources. The challenge is further compounded by the rapid pace of technological advancements and market demands, which require a more dynamic and responsive approach to knowledge management. Addressing these issues is crucial for enhancing the operational efficiency and innovation capacity of SMEs, enabling them to maintain competitiveness in a fast-evolving industry.

2.2. Difficulties in mining and utilizing tacit knowledge

Knowledge within an organization can be divided into explicit knowledge and tacit knowledge. Explicit knowledge refers to knowledge that can be articulated through written text, diagrams, and mathematical formulas. Tacit knowledge, on the other hand, encompasses practical experience, skills, ideas, and creativity that are difficult to express in the above forms. Tacit knowledge, acquired through practical experience, is often hard to articulate clearly, yet it is crucial for an organization's competitive advantage and innovation. It resides in individuals' minds and bodies, shaped by their unique experiences and skills. Despite its significance, tacit knowledge poses challenges in acquisition and transfer due to its personalized and context-specific nature ^[7,8].

Organizational culture and leadership play critical roles in fostering effective tacit knowledge management practices. Essentially, tacit knowledge is the cornerstone of innovation and problem-solving. Organizations can maximize their potential by recognizing their value and implementing comprehensive knowledge management strategies. Developing a robust management system requires an emphasis on cultivating specialized talent. In practical work, the transfer of tacit knowledge relies on experienced employees to convey and preserve it [9]. However, manufacturing SMEs often lack effective means and methods for knowledge acquisition, retention, and accumulation. One major issue in knowledge management for manufacturing SMEs is how to accurately summarize orally conveyed or demonstrated knowledge and experience into concrete knowledge assets.

2.3. Weak alignment between knowledge and business operations

Currently, the process of “learning in order to practice” within manufacturing SMEs is often prolonged and inefficient. Knowledge utilization primarily occurs during off-hours, when employees engage in learning and understanding outside of their regular work tasks. This setup makes it challenging for employees to actively engage with and utilize knowledge resources during their regular work hours. Typically, these resources are accessed by new employees or a small number of highly motivated learners, while the majority of employees only recognize their need for knowledge resources when faced with specific work-related situations.

Retaining knowledge data from business processes within enterprise knowledge management platforms poses a significant challenge. The difficulty lies in seamlessly integrating these knowledge resources into daily business operations. Consequently, there are very limited scenarios where precise knowledge push services can be proactively provided within the flow of business activities. This gap results in a reactive approach to knowledge utilization, where employees seek out knowledge resources only when immediate needs arise, rather than having continuous access to relevant information [6].

This reactive approach not only hampers the efficiency of knowledge transfer but also limits the potential for innovation and continuous improvement within the organization. To address these issues, it is crucial to develop more effective strategies for embedding knowledge management into everyday business processes. This includes creating systems that facilitate real-time access to relevant knowledge and promoting a culture that values ongoing learning and knowledge sharing among all employees. By doing so, SMEs can significantly enhance their operational efficiency and foster a more agile and knowledgeable workforce.

2.4. Challenges in standardizing data versions across diverse types of knowledge

In the manufacturing sector, SMEs often operate in highly specialized niches, resulting in a diverse array of knowledge resources from various fields. These knowledge types typically include craft, technical, management, market, and knowledge of regulations and standards. However, due to the lack of mature management systems, these companies often face significant challenges, such as data silos across different departments, difficulty in version control, diverse data formats, and data duplication.

The absence of standardized data exacerbates these issues, making it difficult to unify the various versions of extensive knowledge resources. This fragmentation leads to substantial challenges in knowledge sharing, linking, and utilization. Data silos prevent seamless communication and collaboration between departments, impeding the flow of critical information. Difficulty in version control results in inconsistencies and inaccuracies, undermining the reliability of knowledge resources. The presence of diverse data formats complicates the integration process, while data duplication creates redundancy and inefficiency.

Moreover, the lack of standardized data means that even when valuable knowledge exists within the organization, it cannot be effectively leveraged to its full potential. This situation hinders the overall operational efficiency and innovation capacity of SMEs, as employees are unable to access and utilize the most relevant and

accurate information when needed ^[8].

To overcome these challenges, SMEs need to develop and implement robust knowledge management systems that promote standardization and integration of data. Such systems should facilitate the unification of knowledge resources, enabling seamless sharing and utilization across the organization. By addressing these issues, SMEs can enhance their operational efficiency, foster innovation, and maintain competitiveness in their specialized niches.

Furthermore, cultivating a culture of continuous learning and knowledge sharing is crucial. Encouraging employees to actively engage with and contribute to the knowledge management system can significantly improve the overall effectiveness of knowledge utilization. In doing so, SMEs can ensure that their valuable knowledge resources are not only preserved but also dynamically applied to drive growth and success.

3. Implementation of knowledge management in manufacturing SME

Knowledge management in manufacturing SMEs is achieved through two main aspects: management planning and technological development. In terms of management planning, this includes designing a top-level knowledge management implementation model, conducting knowledge operations activities, and establishing a knowledge-sharing culture. Technological research and development involves deploying a knowledge classification system and a knowledge management platform.

3.1. Designing a top-level knowledge management implementation model and establishing an operational support system

Designing a top-level knowledge management implementation model and establishing an effective operational support system are crucial for ensuring the success of knowledge management initiatives and are essential for achieving effective knowledge management within the organization ^[10].

3.1.1. Determine effective implementation methods for knowledge management

By drawing on the successful experiences of domestic and international manufacturing enterprises, understand the current and existing knowledge management problems. Based on the company's business characteristics and knowledge management situation, conduct internal knowledge needs surveys, gather business requirements, and explore application scenarios. Clearly define the three-phase tasks for implementing knowledge management:

- (1) Focus on the company's core business, initiate pilot departments, establish a knowledge classification system, build a knowledge base, and develop software.
- (2) Conduct knowledge mining and application, increase knowledge quantity, and enhance knowledge quality.
- (3) Extend knowledge management to all departments, expand the scope of knowledge management applications, and achieve business process automation.

3.1.2. Establish a KM system tailored to the organization's characteristics

A comprehensive organizational management system is essential for effective KM. This involves creating a dedicated knowledge management department, which includes top-level planning and decision-making, cross-departmental and interdisciplinary KM support, technical guidance from experts, and the establishment of KM policies and procedures. A well-structured and thorough knowledge management system can enhance work efficiency and elevate the overall level of KM within the company.

3.2. Conduct knowledge management activities and foster a knowledge-sharing corporate

culture

For a company to successfully adopt knowledge management, it must cultivate a learning and sharing corporate culture. This culture, developed according to knowledge management principles, guides the company's growth and development. Manufacturing SMEs can organize a variety of knowledge management activities, such as training on KM systems, knowledge competitions, and soliciting proposals for knowledge management improvements. These activities ensure the continuous introduction of new knowledge, ongoing optimization of the knowledge management system, and enrichment of application scenarios. Promoting a culture of full participation and encouraging employees to change their work habits and practices, fostering knowledge sharing, exchange, transfer, and application, thereby maximizing the value of knowledge ^[11].

4. Recommendations for adopting knowledge management in manufacturing SME

Adopting a comprehensive and systematic approach to knowledge management is essential for the digital transformation of manufacturing SMEs. However, challenges and issues are likely to arise during the promotion and implementation process. To accelerate the advancement of KM within these enterprises, the following recommendations are proposed ^[6].

4.1. Improve employees' knowledge management awareness and accelerate talent development

Top managers and decision-makers must recognize the critical importance of knowledge management and demonstrate a strong commitment to its implementation. Their active involvement is essential for fostering a culture that values and prioritizes KM. Having personnel with experience in KM is crucial for its success. Therefore, companies should prioritize recruiting or developing experts who are skilled in KM methods and establish dedicated departments or positions.

This approach will significantly accelerate the adoption of KM practices, ensuring that the organization is equipped with a team of skilled professionals who can effectively manage and leverage knowledge resources. By building a robust KM infrastructure, companies can enhance their ability to innovate, improve operational efficiency, and maintain a competitive edge in the market. Moreover, dedicated KM departments or positions will facilitate the development and maintenance of comprehensive KM systems, tailored to the specific needs of the organization. These departments can also provide ongoing training and support to employees, helping them to effectively utilize KM tools and practices in their daily work.

Additionally, a strong focus on KM will enable organizations to better capture and disseminate critical knowledge, reducing the risk of knowledge loss due to employee turnover and ensuring continuity in business operations. By embedding KM into the organizational culture and making it a core component of business strategy, top managers and decision-makers can drive sustainable growth and long-term success ^[12].

4.2. Develop a comprehensive KM standards system to standardize and support knowledge management implementation

As the company embarks on implementing knowledge management (KM), it is crucial to focus on developing and establishing a comprehensive standards system. Creating a clear, robust, and efficient set of standards and processes tailored to the company's specific needs is essential. This approach will ensure effective knowledge management, enhance the company's overall KM capabilities, and establish a sustainable framework to support ongoing efforts.

A well-defined standards system will serve as a foundation for consistent and reliable KM practices across

the organization. This includes setting guidelines for knowledge creation, storage, sharing, and utilization, ensuring that all employees adhere to the same protocols. By doing so, the company can minimize discrepancies and inconsistencies in knowledge handling, thereby improving the accuracy and reliability of information.

Moreover, developing a tailored set of standards and processes will enable the company to address its unique challenges and requirements. This customization ensures that the KM system aligns with the company's strategic goals and operational workflows, making it more relevant and effective. The standards should be designed to facilitate seamless integration with existing systems and processes, promoting a smooth transition to the new KM practices.

Implementing a robust standards system also contributes to the sustainability of KM efforts. It provides a structured framework that can be maintained and updated as the company evolves, ensuring that KM practices remain relevant and effective over time. This ongoing support is vital for adapting to changing business environments and technological advancements, enabling the company to continuously improve its KM capabilities.

Additionally, a clear and efficient set of standards and processes will enhance employee engagement and participation in KM activities. When employees understand the expectations and procedures for knowledge management, they are more likely to actively contribute and utilize KM resources. This increased engagement fosters a culture of continuous learning and knowledge sharing, further strengthening the company's KM capabilities ^[13].

4.3. Select key departments for pilot projects at the right time to gain practical experience

While developing the KM system and learning relevant theories and tools, it's essential to advance pilot initiatives simultaneously. Begin by implementing KM in key departments, focusing on knowledge acquisition, storage, management, and application. Carefully document and analyze the experiences gained from these pilot initiatives before gradually expanding the approach to other departments. Select departments with diverse types of knowledge and rich application scenarios for the pilot phase.

While developing the knowledge management system and learning relevant theories and tools, it is essential to advance pilot initiatives simultaneously. Begin by implementing KM in key departments, with a focus on knowledge acquisition, storage, management, and application. Carefully document and analyze the experiences gained from these pilot initiatives before gradually expanding the approach to other departments.

To ensure the effectiveness of the pilot initiatives, select departments that possess diverse types of knowledge and have rich application scenarios. This diversity will provide a comprehensive understanding of how KM practices can be adapted and optimized for different contexts within the organization. By focusing on key departments initially, you can create a solid foundation for KM that can be built upon as you expand the initiative.

Once the pilot initiatives have demonstrated success and provided valuable insights, gradually expand the KM practices to other departments. Tailor the approach based on the unique needs and characteristics of each department, leveraging the documented experiences from the pilot phase to guide the expansion.

In summary, advancing pilot initiatives while developing the KM system and learning relevant theories and tools is essential for successful implementation. By focusing on key departments initially, documenting and analyzing experiences, and gradually expanding the approach, the company can build a robust and effective KM system that enhances knowledge acquisition, storage, management, and application across the entire organization ^[5].

5. Conclusion

KM plays a crucial role in SMEs within the manufacturing sector. By systematically identifying and addressing issues in KM, companies can build and refine their KM systems, expand application scenarios, and enhance

operational capabilities. Future advancements in KM for manufacturing SMEs can focus on three key areas: improving practitioner capabilities, standardizing KM systems, and adapting to diverse business scenarios. The goal should be to make tacit knowledge explicit, systematize explicit knowledge, contextualize knowledge application, and enhance value through knowledge reuse. These efforts will support the digital transformation of manufacturing SMEs.

Disclosure statement

The authors declare no conflict of interest.

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