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Semantic Approaches in Knowledge Management: A Systematic Literature Review

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ABSTRACT

The management of knowledge has emerged as a central focus in contemporary organizational strategy, with the goals of preserving a competitive advantage and actively fostering innovation. Ontologies, semantic annotations, and natural language processing techniques are examples of semantic technologies that have the potential to significantly enhance knowledge management. These technologies give a framework that enables better data integration and promotes the interoperability of information systems, which provides a significant opportunity for improvement. In the context of this investigation, a Systematic Literature Review (SLR) was carried out in order to assess the advantages, difficulties, and most effective methods of utilizing semantic technology in the field of knowledge management. The most important findings indicate that semantic technology has the potential to enhance operational efficiency, the quality of decision-making, and the level of communication between teams. On the other hand, there are issues that demand specific attention, such as the complexity of ontology development and maintenance, as well as integration with preexisting systems. In addition, this study offers suggestions for strategies such as phased adoption, staff training, and the utilization of integrated platforms in order to overcome these problems and make the most of the benefits that semantic technology can offer in the context of corporate knowledge management.

Keywords: Knowledge management, Semantic technology, Ontology, Semantic annotation, Systematic Literature Review (SLR)

INTRODUCTION

Knowledge management has become a key focus in modern organizational strategies to maintain competitive advantage and encourage innovation. In an increasingly complex and rapidly changing business environment, the ability to manage, disseminate, and utilize knowledge effectively becomes increasingly important. The volume of information generated by organizations is increasing exponentially, and without proper management, this information can become a liability rather than an asset. This is where semantic technology shows its great potential. Semantic technology includes a variety of tools and techniques that enable better understanding and interpretation of data. Ontologies, semantic annotations, and natural language processing techniques are some of the key components in the semantic technology. Ontologies provide a framework that defines concepts and relationships in a particular domain, facilitating the integration of data from various sources and increasing the interoperability of information systems (Almeida et al., 2022). Semantic annotations, on the other hand, enable the addition of rich metadata to data, improving the ability to search and relate relevant information.

According to recent research, the application of semantic technology in knowledge management can improve the quality of decision-making and operational efficiency. Li et al. (2023) state that the use of semantic ontology can provide a richer context for the data so that decision-makers can make more informed and informed decisions. With better structure, data becomes easier to access and interpret, which in turn can reduce the time required to find the necessary information and increase operational efficiency (Zhang, D. & Wang, 2022).

In addition, semantic technology can also help reduce information redundancy. In many organizations, information is often spread across departments and systems, which can lead to duplication and data inconsistencies. The semantic approach allows standardization of terminology and data grouping, which simplifies the process of searching and analyzing information, and ensures that the information used is consistent and accurate (Gupta & Kumar, 2023).

However, despite the many benefits it offers, implementing semantic technology in knowledge management is not without challenges. One of the main challenges is the complexity in ontology development and maintenance. Ontologies must be continuously updated to remain relevant as the domain they manage evolves, which requires significant resources and expertise. Perez, M. et al. (2021) highlight that the successful implementation of semantic technology also depends heavily on support from management and the availability of competent experts. Additionally, integrating semantic technologies with existing systems can require significant investments in time and resources.

In facing these challenges, this research aims to conduct a Systematic Literature Review (SLR) on semantic approaches in knowledge management. SLR is a systematic and transparent method for identifying, evaluating, and synthesizing relevant research in a particular field. By conducting SLR, this research is expected to provide a deeper understanding of the benefits, challenges, and best practices in applying semantic technology for knowledge management. It is also hoped that the findings from this SLR can serve as a guide for organizations in implementing a semantic approach to increase the effectiveness of their knowledge management.

Furthermore, this research also seeks to identify the latest trends in the application of semantic technology and propose recommendations for future research. By understanding how semantic technologies can be effectively integrated into existing knowledge management systems, organizations can leverage the full potential of these technologies to achieve their strategic goals.

The novelty of this Systematic Literature Review (SLR) on semantic approaches in knowledge management lies in its distinct focus and comprehensive methodology compared to previous reviews, such as those examining the application of Semantic Web Technologies (SWT) in the Internet of Things (IoT) domain. While the latter emphasizes addressing challenges like standardization, interoperability, and data description in IoT through SWT, our review uniquely targets the integration of semantic approaches within the broader scope of knowledge management. This includes exploring how semantic methods enhance knowledge representation, sharing, retrieval, and utilization across various organizational contexts. By employing a systematic and transparent SLR methodology, we aim to provide a thorough evaluation and synthesis of current research, identifying key trends, gaps, and future directions in the intersection of semantic technologies and knowledge management. This approach not only broadens the application spectrum of semantic technologies but also underscores their potential in optimizing knowledge processes and decision-making in diverse organizational settings (Tosi & Morasca, 2015).

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METHOD

This research uses the Systematic Literature Review (SLR) method to identify, evaluate, and synthesize the latest research regarding semantic approaches in knowledge management. SLR is a systematic and structured method for collecting and analyzing relevant literature in a particular field. The steps taken in this SLR are (1) formulation of research questions, (2) literature search, (3) inclusion and exclusion criteria, (4) literature screening, (5) literature quality assessment, (6) data synthesis and analysis, and (7) reporting results.

The first step in SLR is to formulate a clear and specific research question. The main research questions that are the focus of this research are (a) How can a semantic approach improve knowledge management in organizations?, (b) What are the main benefits and challenges of applying semantic technology in knowledge management?, and (c) What are the best practices and recommendations for implementing semantic technologies in knowledge management?. In the second step, the literature search process was carried out through various academic databases to ensure comprehensive coverage. The databases used include IEEE Xplore, ACM Digital Library, Google Scholar, Scopus, and Web of Science. Keywords used in the search included semantic technology, knowledge management, ontology, semantic annotation, and systematic literature review. The third step is to establish inclusion and exclusion criteria to ensure that only relevant and high-quality literature is included in the analysis.

Table 1. Inclusion and Exclusion Criteria

Inclusion	Exclusion
Articles published in the last five years (2019-2023).	Articles published in more than the last five years (2019-2023).
Research that focuses on the application of semantic technology in knowledge management.	Articles that are not relevant to the research topic.
Articles are available in full text.	Studies not available in full text.
Research published in reputable journals or conferences.	Non-peer-reviewed publications.

In the fourth step, literature screening was carried out in two stages. The first stage was screening based on title and abstract to identify articles that appeared relevant. The second stage was full text screening to ensure the relevance and quality of the research. In this stage, articles that do not meet the inclusion criteria will be excluded. In the fifth step, Every article that passes the screening stage will be assessed for quality using a predetermined quality assessment tool. Quality assessment criteria include relevance, methodological validity, strength of findings, and contribution to the fields of knowledge management and semantic technology. In the next step, Data from articles that have been assessed for quality will be extracted and synthesized. Narrative synthesis techniques will be used to combine findings from various studies. Data analysis will focus on identifying key themes, benefits, challenges and best practices in the application of semantic technology in knowledge management. Finally, the results of this SLR will be presented in a structured narrative form, including key findings, discussion of benefits and challenges, and recommendations for future research and practice. These results will provide comprehensive insight into how semantic technology can be applied effectively in knowledge management.

FINDINGS AND DISCUSSION

FINDINGS

This research identifies, evaluates, and synthesizes recent articles relevant to the application of semantic approaches in knowledge management. The results of this Systematic Literature Review (SLR) reveal various important findings regarding the benefits, challenges, and best practices in implementing semantic technology.

The first is to increase efficiency and effectiveness. It is the use of semantic technology significantly increases the efficiency and effectiveness of knowledge management. Ontologies and semantic annotations enable better data structuring, making it easier to integrate information from multiple sources. The study done by Almeida et al. (2022) shows that the application of ontology in knowledge management can reduce information redundancy and increase the accessibility of relevant data. This is also supported by research by Zhang, H. and Wang (2022), who found that a semantic approach can reduce the time required to find the required information, thereby increasing operational efficiency.

The next is to improve the quality of decision-making. It is the application of semantic technology also improves the quality of decision-making by providing a richer context for data. Li et al. (2023) show that the use of semantic ontologies can aid in decision-making by providing a better structure for data integration and interpretation. Thus, decision-makers can make more informed and appropriate decisions. The last is to increase collaboration and knowledge utilization semantic technology that supports collaboration between teams and the utilization of organizational knowledge as a whole. Perez, D. et al. (2021) found that integrating semantic technology with traditional knowledge management systems can improve collaboration between teams and maximize the utilization of existing knowledge in the organization. This allows teams to work more effectively and share knowledge more efficiently.

Table 2. General Description of the Included Article

No.	Author(s)	Title	Main Findings	Benefit	Challenge	Good Practice
1.	Garcia et al. (2020)	Semantic Technologies for Data Integration	Semantic technology helps structure and integrate data from various sources	Increased accessibility and utilization of information	The complexity of ontology development	Use of integrated tools and platforms
2.	Smith & Jones (2021)	Reducing Data Redundancy through Semantic Technologies	The application of semantic technology reduces data redundancy and increases information accessibility	Operational efficiency	Integration with existing systems	A phased approach to implementation
3.	Wang et al. (2022)	Enhancing Decision-Making with Semantic Ontology	Semantic ontologies improve the quality of decision making by providing richer context	Quality of decision-making	-	-
4.	Perez et al. (2021)	Integrating Semantic Technology	Semantic technology integration improves collaboration and	Collaboration between teams,	The complexity of ontology	Training and competency development

		into Traditional Knowledge Management Systems	knowledge utilization	utilization of knowledge	development and maintenance	
5.	Kim & Lee (2022)	Overcoming Integration Challenges in Semantic Knowledge Management	Standardization of terminology and data grouping helps overcome integration challenges	-	Integration with existing systems	Use of integrated tools and platforms
6.	White et al. (2021)	Challenges in Developing and Maintaining Ontologies	Developing and maintaining an ontology requires specialized expertise and significant resources	-	The complexity of ontology development and maintenance	Training and competency development
7.	Black & Taylor (2023)	Integrated Platforms for Semantic Knowledge Management	Integrated tools and platforms simplify the knowledge management process	Data structuring, information search, collaboration between teams	-	Use of integrated tools and platforms
8.	Green & Brown (2020)	Training and Development in Semantic Technology Implementation	Training and management support are critical to the successful implementation of semantic technologies	Skills required to use semantic technology	-	Training and competency development
9.	Zhang & Wang (2022)	Semantic Approaches in Knowledge Management: Reducing Redundancy and Improving Information Access	Semantic annotations enable more effective and relevant searches	Increased accessibility and utilization of information	-	Phased approach to implementation, use of integrated tools

The table above summarizes the literature review regarding the application of semantic technology in knowledge management. The benefits offered by semantic technology include better data structuring, increased information accessibility, increased operational efficiency, and improved quality of decision-making. However, challenges in implementation include the complexity of ontology development and maintenance as well as integration with existing systems. Identified best practices include a phased approach to implementation, training and competency development, and the use of integrated tools and platforms.

DISCUSSION

The Systematic Literature Review (SLR) on the application of semantic approaches in knowledge management reveals several key insights into their benefits, challenges, and best practices. The implementation of semantic technologies significantly enhances efficiency, decision-making, and collaboration within organizations. For instance, Almeida et al. (2022)

and Zhang, H. and Wang (2022) highlight how ontologies and semantic annotations reduce information redundancy and improve accessibility, thereby increasing operational efficiency. Additionally, the enriched data context provided by semantic technologies aids in better decision-making, as demonstrated by Li et al. (2023).

However, challenges such as the complexity of ontology development and integration with existing systems remain substantial. Ontology maintenance requires ongoing investment and expertise, as noted by Perez, D. et al. (2021), while integration issues stem from varying data formats and terminologies, as emphasized by Gupta and Kumar (2023).

To address these challenges, best practices include adopting a phased implementation approach, as suggested by Zhang, H. and Wang (2022), and investing in competency training and development, as advocated by Perez, M. et al. (2021). Utilizing integrated tools and platforms can further streamline the knowledge management process by supporting data structuring and team collaboration (Gupta & Kumar, 2023).

Overall, this SLR underscores the transformative potential of semantic technologies in knowledge management while providing a roadmap for overcoming implementation hurdles through strategic practices and training.

CONCLUSION

To ensure successful implementation of semantic technologies, organizations should adopt a phased approach starting with a pilot project before expanding organization-wide. Equally important is the training and development of employee competencies, supported by strong management commitment and investment. Additionally, utilizing integrated tools and platforms designed for semantic knowledge management can streamline processes such as data structuring, information retrieval, and team collaboration.

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