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Survey of Industry Centric Knowledge Management Techniques

Arasanipalai Mohan Aditya[1]
[1]*National University of Singapore, 25 Heng Mui Keng Terrace, Singapore*

Pranjal Dubey[2]
[2]*National University of Singapore, 25 Heng Mui Keng Terrace, Singapore*

Abstract:

Today, industries such as healthcare, advanced manufacturing and automotive among others, require skilled operators with highly specialized domain knowledge. This knowledge embedded within such specialists is generally heuristic in nature. It is empirical that this knowledge be made more approachable and reusable. This paper talks about several such knowledge management techniques and frameworks along with their uses and shortcomings.

Keywords

Knowledge management, taxonomy, knowledge engineering, heuristic knowledge

1. Introduction

Ongoing research and development in knowledge engineering, especially in extracting heuristic knowledge and taxonomy structuring, focus only on a defined sector of the industry and do not account for the scalability and reusability across different sectors. Such shortcomings emphasize the need for a generalized framework that could efficiently capture various kinds of knowledge and manage it in an optimized method. Many commercial firms and research institutions are working towards creating a centralized repository pertaining to all sectors of the industry, but still lack the generality and efficiency required at an industry level. This in turn leads to disruption of the entire chain of knowledge acquisition to knowledge transfer, and industries do not usually end up getting the best of both.

The following section provides a systematic study of the knowledge engineering methods adopted by various institutions and researchers along with their pros and cons.

2. Literature Survey

In [1], the authors present a knowledge framework to make seamless enterprise interoperable intelligent manufacturing systems using semantically enriched international data standards and knowledge representation elements. Their developed knowledge framework is called “funStep” which provides enterprise and manufacturing systems a semantically seamless communication with stakeholders up and down the supply chain. They agree to the fact that each stakeholder has its own nomenclature and associated meaning for its business products and therefore organizations from similar business environments have trouble cooperating. The “funStep” knowledge framework uses different KREs as catalysts to enable such semantic interoperability. Together, the domain dictionary, the thesaurus, the reference ontology and the AP236 standard itself act as an explicit knowledge repository and reference lexicon for the application domain. Despite all this, adapting the framework to new terminologies, modifications of existing concepts and other such perturbations, have not been taken care of and the authors claim that automatic readjustment is a challenging task.

Marte B. et al, in [2], talks about how the availability of a taxonomy based framework may be utilized to enhance the access and interface functionalities of learning systems. The author emphasizes on how the Competence-based Knowledge Space Theory model can help in designing effective Units of Learning (UoL), by considering not only the current pedagogical trends but also incorporating skills that refer to the conceptual information of the domain as well as to the activities learners are expected to perform in this context. This paper serves as a very good starting point to those who wish to design systems with finely grained learning objectives. Further research work would involve automatically assigning activities to certain levels of the taxonomy. The authors also suggest the use of fuzzy assignments into the taxonomy rather than setting hard limits.

The authors in [3] claim that there is no specific knowledge management methodology or system for industry clusters. They proposed a knowledge management system which would help the industry clusters. The KMS methodology was divided into the knowledge engineering and the knowledge system development processes. The authors made use of the European de facto CommonKADS methodology for knowledge engineering. The knowledge system and acquisition modules focused on supporting the knowledge engineering module. The authors tested their cluster framework across the handicraft industry and the main issue they faced was catering to the unique requirement specifications from the customer.

Geoffrey L. Gatton, in [4], talks about the measurement aspect on the manufacture of aerospace components using manufacturing robotics. The author explains the various tasks and techniques associated with modern manufacturing methods and that the criticality of the accuracy and integrity of the definition of the component part. The author talks about various instances wherein lack of knowledge and a streamlined process caused hiccups along the way. To quote the author, "As the complexity and capability of manufacturing equipment has continued to develop we are now seeing an advantage to have data rich models for multiple axis capability machines." This paper confirms that as the data models grow richer, advantage can be taken with respect to all the technological advances in the domain of manufacturing robotics.

The authors in [5] propose an assembly taxonomy designed to represent the decomposition of high-level, complex assembly tasks into simple skills and skill primitives that the robot must use in a specified sequence. The method proposed aims to reuse knowledge in various manufacturing robotics systems, making it possible to reduce programming time and overhead. The paper specifically also talks about how robot programming can be made more intuitive and more accessible to operators with less technical experience. An array of previously done works have been presented which help in understanding the various methods that have been incorporated so far and the challenges in this. The takeaway from this is that development of such taxonomy frameworks which can be made adaptable can simplify knowledge reusability considerably, which leads to reducing time and financial overhead.

In [6], the authors talk about how identifying existing, codified knowledge ontology can be integrated into other methods to improve the efficiency of knowledge ontology identification, validation and evolution. It can provide a common foundation for inter organizational progress. The paper talks about how ontology is emerging in popularity and the importance of domain experts while formulating the ontology. It also presents a comprehensive comparison between different ontology techniques. The paper also derives the importance of having precise knowledge by the help of an FA/FI failure analysis. The author says that knowledge about failure, especially that affecting core business, provides organizations with powerful strategic and operational advantages. This is in-line with our CommonKADS de facto architecture.

N. Askarov et al, in [7] talk about the benefits and challenges of developing and using Web-based applications for Expert Systems. The authors present two examples to illustrate the same. The first one called WITS (Web-based intelligent training and support system) was developed for providing training and intelligent support to SME's on the use of ICT. The system stemmed from the fact that there was lack of adequate skills and knowledge in small and medium sized enterprises. The second example was a Fish disease diagnosis system which could replicate human fish disease expertise since adequate knowledge about the same could be gathered from subject matter experts. This paper basically highlights the important factors to be considered while building a web based expert system.

Yushan Zhao [10], talks about the impact of relationship strength on the tacit knowledge transfer from manufacturing firms to suppliers in new product development. The study tests the mediating effect of tacit knowledge transfer on the relationship between tacit knowledge transfer and suppliers' new product performance with the help of a model. The testing of this hypothesis will enhance the understanding of the role of tacit knowledge in NPD. The study proposes that technology uncertainty moderates the impact of relationship strength and tacit knowledge transfer. There are some theoretical and managerial implications from this study. First, tacit knowledge transfer and management is a central issue in this study. Resource-based theory has long recognized that knowledge is a source of competitive advantage for firms. This study shows that tacit knowledge is critical for suppliers' new product success. Manufacturing firms have a strategy of supplier development to help suppliers improve production efficiency, reduce costs, and enhance product performance. This concept can be further extended to transfer of tacit knowledge to new operators and users as well.

B. Faust [11] talks about two important elements of knowledge management, preservation and transfer. He agrees that 80% of the most important knowledge is unconscious and talks about the need of cognitive schemata/mental models for storing and transferring knowledge. The author talks about the use of the SECI model for knowledge conversion and storing the knowledge in electronic storage and ontology based databases. He also emphasizes on using rudimentary methods such as mentor programs, seminars, interviews, stories and advanced methods such as VR for knowledge transfer. The author concludes by saying that many KM-Initiatives have failed due to the lack of specified methods for conserving tacit knowledge.

The literature shows that those researchers who are working on building knowledge management systems for example, in the manufacturing sector using advanced robotic technologies face difficulty in adapting their designed framework to new terminologies [1][2], modifying existing concepts and automatic readjustments. Different customers have their own unique requirements and there its difficulty catering to those requirements [3]. Researchers claim that as the data models grow richer, the development of taxonomic frameworks can be made more adaptable and reusable [4][5]. Some authors also agree with the fact that knowledge transfer requires detecting domain experts and verification and validation of the knowledge acquired [7][8][9]. All these challenges need to be addressed and to be solved by efficient framework architecture.

The knowledge management system for any sector aims to emulate the five W's and one H structure while formulating the taxonomy and ontology since this would be in-line with how heuristic information is stored.

3. Conclusion

Through the above section we have successfully understood that knowledge engineering is not easy task and has not yet reached its peak in terms of achieving generality across industries. Different industries persist on using their own defined formats for knowledge management.

As the 'Hype Cycle' rightly points out, it is not long before traditional knowledge management methods form a big part of research again. Even today, researchers and industries are striving towards formulating a common framework to enable seamless knowledge sharing.

4. References

[i] Ricardo Goncalves, Joao Sarraipa, Carlos Agostinho, Herve Panetto. Knowledge framework for intelligent manufacturing systems, *Journal of Intelligent Manufacturing, Springer Verlag (Germany)*, 2011, 22 (5), pp.725-735.

[ii] Marte, B., Steiner, C. M., Heller, J., & Albert, D. (2008). Activity and Taxonomy-Based Knowledge Representation Framework. *International Journal of Knowledge and Learning*, 4, 189-202.

[iii] Pradorn Sureephong, Nopasit Chakpitak, Yacine Ouzrout, Gilles Neubert, Abdelaziz Bouras. Knowledge Management System Architecture for the Industry Cluster. *The International Conference on Industrial Engineering and Engineering Management (IEEM 2007)*, Dec 2007, Singapore, 2007.

[iv] Geoffrey L. Gatton, Modern Manufacturing with Measure, Rolls-Royce North America

[v] Jacob Huckaby, Henrik I. Christensen, A Taxonomic Framework for Task Modeling and Knowledge Transfer in Manufacturing Robotics, Cognitive Robotics, *AAAI Technical Report* WS-12-06

[vi] Theresa Edgington, T. S. Raghu, Ajay Vinze, Knowledge Ontology: A Method for Empirical Identification of 'As-Is' Contextual Knowledge, *Proceedings of the 38th Hawaii International Conference on System Sciences – 2005*

[vii] N. Askarov, K. Kozhakhmet, L. Atymtayeva, Analysis of web-based applications for expert system, *Computer Modelling and New Technologies*, 2011, Vol.15, No.4, 41–45

[viii] Ioannis M. Dokas, Developing Websites For Web Based Expert Systems: A Web Engineering Approach

[ix] Jeenal Vora, Santosh Nair, Anand K Gramopadhye, Andrew T Duchowskib, Brian J Melloya, Barbara Kankic, "Using virtual reality technology for aircraft visual inspection training: presence and comparison studies"

[x] Yushan Zhao, "Tacit Knowledge Transfer from Manufacturing Firms to Suppliers in New Product Development: A Study of Suppliers," *International Journal of Information and Education Technology*, Vol. 3, No. 5, October 2013

[xi] B. Faust, "Implementation of Tacit Knowledge Preservation and Transfer Methods," IAEA-CN-153/2/P/24