Chapter 21
A Survey of Ontology-Based Frameworks for Sustainable Supply Chain Interoperability and Collaboration

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ABSTRACT

Accurate and meaningful sharing of knowledge across the supply chain enables effective and timely decision making, a key requirement for ensuring cost-effectiveness, availability, and quality of products and services. Effective elicitation, analysis, classification, and representation of domain knowledge are all essential activities for effective sharing of information. Ontology-based frameworks create a common formal representation of a particular domain that can be communicated, and understood by people and machine agents in addition to integrating different knowledge bases to connect heterogeneous engineering applications. Such frameworks have been exploited in the manufacturing domain as buyer-supplier discovery systems that can be used for quick matchmaking, intelligent connectivity, knowledge-driven collaboration, and possible establishment of stronger, sustainable, long-term, and strategic supply chains. A literature review has identified many frameworks with varying knowledge sharing capabilities that are highly determined by the underlying ontological formalism.

LITERATURE REVIEW

A Survey of Different Approaches in Ontological Frameworks

The main purpose of this survey is cover the topic from different angles and to create a cohesive unit of knowledge based on the large number of references that have been reviewed by the author. The information presented has been collected and referenced from many different sources in an effort to bring valid, pertinent and complementary knowledge that can connect the different areas covered by this research.

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Table 1. Outline of Existing Works

Principles-Guidelines	Toward Principles for the Design of Ontologies Used for Knowledge Sharing, Thomas R. Gruber, 1993
	Knowledge Engineering: Principles and methods, Rudi Studer, V. Richard Benjamins, Dieter Fensel, 1997
Defining and Measuring Supply Chain Interoperability	Using Supply Chain Interoperability as a Measure of Supply Chain Performance. Chalyvidis C, Ogden J, Johnson A., 2013
A Coordination Framework for Manufacturing	Ontology- Driven Coordination for Supply Chain System, Xin J, 2005
A Modular General-Purpose Framework Supply Chain Management	Ontology-based semantic models for supply chain management. Ye Y, Yang D, Jiang Z, Tong L. 2007
	Research on ontology-based integration of product knowledge for collaborative manufacturing, Yang, J; Gaoliang, P; Wenjian, L., 2010
Agile SC Deployment for buyer-Supplier Discovery – A short term solution	Digital manufacturing market: a semantic web-based framework for agile supply chain deployment, Ameri F, Patil L., 2012
	Semantic rule modelling for intelligent supplier discovery, Ameri F, McArthur C., 2014
A long-term extendible, interoperable solution using object-oriented technologies, UML based tools, and creating reference ontology.	Reference ontologies to support the development of global production network systems. Palmer C, Urwin E, Young R, et al., 2016
	Interoperable manufacturing knowledge systems. Palmer C, Young R, Usman Z, Canciglieri Junior O, Malucelli A., 2017
	Exploiting unified modelling language (UML) as a preliminary design tool for Common Logic-based ontologies in manufacturing. Palmer C, Chungoora N, Harding J, et al., 2013
	An Ontology for global production network design and reconfiguration. Palmer, C, Cuel, R. and Young, R. 2015
Exploring Model-Driven Engineering Design Technologies as a basis for Ontological framework development.	Reference ontologies for interoperability across multiple assembly systems. Imran M, Young R., 2016;
	An ontology framework for developing platform-independent knowledge-based engineering systems in the aerospace industry. Sanya I, Shehab E., 2014

Knowledge Representation is an evolving task that needs to be continually adapted and extended in order to be able to address the new challenges and requirements in information management.

Outline of Existing Works

It has also been observed that the knowledge sharing capabilities achieved by an ontology-based approach (framework) is highly determined by the choice of the underlying logic base or ontological formalism. An Ontological Formalism is a formal language that supports the construction of an ontology-based model of the subject matter (Chungoora 2010). To date, several such formalisms have been exploited to develop ontological frameworks that have been successfully implemented to represent the design and manufacturing domains. However, no clear consensus has been reached on a preferred approach.

This survey takes a Software Engineering approach for an overview of several Ontology-based frameworks. Gruber 1993 and Studer et al. 1997 are both highly-cited early works in ontology. Both works have