

## Chapter 4.22

# Development of an Ontology to Improve Supply Chain Management (SCM) in the Australian Timber Industry

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### **ABSTRACT**

This chapter proposes an ontology using Web ontology language (OWL) for the Australian timber sector that can be used in conjunction with Semantic Web services to provide effective and cheap business-to-business (B2B) communications. From the perspective of the timber industry sector, this study is important because supply chain efficiency is a key component in an organisation's strategy to gain a competitive advantage in the marketplace. Strong improvement in supply chain performance is possible with improved B2B communication, which is used both for building trust and providing real-time marketing data.

Traditional methods such as electronic data interchange (EDI), which are used to facilitate B2B communication, have a number of disadvantages such as high implementation and running costs and a rigid and inflexible messaging standard. Information and communications technologies (ICT) have supported the emergence of Web-based EDI which maintains the advantages of the traditional paradigm while negating the disadvantages. This has been further extended by the advent of the Semantic Web which rests on the fundamental idea that Web resources should be annotated with semantic markup that captures information about their meaning and facilitates meaningful machine-to-machine communication.

## INTRODUCTION

The Australian forest and wood products industry sector form an important element of the Australian economy, with a turnover exceeding \$14 billion per year. The industry contributes 7.5% of the manufacturing output of the gross domestic product (Australian Bureau of Agricultural and Resource Economics, 2003). Overall the industry sector supports 674 hardwood mills and 268 softwood mills along with 30 panel board mills employing 78,400 people in 2000/2001 (Australian Bureau of Agricultural and Resource Economics, 2003). The forestry industry is growing in importance in Australia. The stated aim of the Department of Agriculture, Fisheries, and Forest (1997) according to its 2020 vision document is to triple plantation area by the year 2020.

The business process of supply chain management (SCM) provides an opportunity to improve business efficiency within this industry, increasing profit margins, and thus favourably impacting the Australian economy. The prospect of improving the efficiency of SCM is provided by new information and communication technologies. EDI is an established technology that provides B2B communication within the supply chain but demands rigid agreements between organisations concerning the structure and content of communications. From the widespread use of Internet technologies has arisen new methods for automated B2B exchange of information using Web-based EDI. This paradigm adopts a flexible, nonplatform-specific open standard in which agreement between organisations participating in the supply chain can be more readily brokered.

One of the mechanisms semantic technologies provides for brokering agreements is by providing instruments designed for unambiguous, loosely coupled data sharing. An ontology provides for the explicit specification of domain knowledge external to any one system. An organisation commits to external ontologies which may be in use

industry-sector wide providing an open standard for B2B communication. Semantic technologies use the domain knowledge to provide machine interpretable context-sensitive information which may be shared (Lee, 2004). Semantic search engines using ontologies allow the retrieval of context-sensitive information that may be coupled with intelligent agents to provide brokering and negotiation capabilities (Schoop et al., 2002). Ontologies for domains other than an industry sector are available, for instance, the Web service modelling ontology proposed by Roman et al. (2005) uses semantic technologies to automate tasks of Web service discovery, composition, and invocation.

## INFORMATION FLOWS IN SCM

A typical business receives inputs from a number of suppliers and may then use a number of channels to sell their goods and services. A supply chain is the flow of information, materials, finances, and services stretching from the procuring of raw materials through the delivery of the finished product to the end user (Turban, King, Lee, & Viehland, 2004). Management of the supply chain is done with the intent of improving customer service levels, cycle time reduction, and increased inventory turnover leading to agile supply chains (Christopher & Towill, 2001). Improvements in these functions increase the effectiveness of business processes leading to improved organisational performance (Power & Sohal, 2002; Prem PremKumar, 2003).

SCM can be defined as a set of tools and techniques applied to coordinate suppliers, manufacturers, warehouses, and retailers so that goods and services are produced and distributed to the required locations within requisite service levels, while minimising logistics costs (Simchi-Levi, Kaminsky, & Simchi-Levi, 2003). Fawcett and Magnan (2002) describe the ideal of supply chain

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