Chapter 6

A Review of Research of Coordination Approaches in Distributed Production Systems

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ABSTRACT

The increasing of global competition and the need for rapid response to market changes drive manufacturing enterprises to adopt new business models. This chapter examines the recent years of research developed in the field of coordination approaches to support distributed production systems. The papers discussed concern the period of 2004-2010 published in international ISI journals. The research articles are classified according to nine fields of research: operational research models; collaborative architecture; negotiation and bargaining models; capacity exchange; revenue sharing; chemical engineering; electronic approach; general review; case study. The analysis of the literature highlights that the articles are distributed uniformly over the years analyzed. The most fields investigated are the collaborative architecture and operational research models, while emerging fields are the chemical engineering and revenue sharing based approaches. The discussion underlines the limitation of the literature and suggests the directions for future research.

INTRODUCTION

Manufacturing enterprises have face to high and global competitive markets that force to change towards new organizational structure. The driving forces can be classified in two categories: market characteristics and Information and Communication Technology (ICT) developments. The market has been continuously changing in terms of demand volatility, shorter production cycles, rapid introduction of new product and introduction of new technologies. From the point of view of ICT,
the development of ICT technologies offer the possibility to support the cooperation of distributed production entities. These driving allow the manufacturing enterprises to develop new form of organization for integration and cooperation among several actors of a supply chain obtaining a production network structure. The manufacturing enterprises that operate in a production network are able to focus on their core competence, react to market changes with more flexibility of the organizational structure and more efficiency of the value chain. The production networks need coordination tools to support the activities of the network and the performance of the structure heavy depend on the methodologies used to develop these tools. (Wiendahl and Lutz, 2002). Basically, two approaches are available for managing production networks: a centralized approach, where a unique entity has got all the necessary information to make planning decisions for the entire network; On the other hand, a decentralized approach can be used; in this case, each entity in the network has the necessary information and knowledge to make autonomous planning decisions, while, the common goal is reached through a cooperation among all the network actors (Lo Nigro et al., 2003). It has been quite acknowledged that, while centralized approaches are theoretically better in pursuing global system performance, they have several drawbacks concerning operational costs, reliability, reactiveness, maintenance costs and so forth (Ertogral and Wu, 2000). Generally, it can be distinguished between two levels of coordination (Bhatnagar et al., 1993): the general level coordination can be seen in terms of integrating decisions of different functions (facility location, distribution, marketing, etc.); the second level regards the coordination problem within the same function (production planning, capacity allocation, etc.). Alvarez(2007) stated that companies are shifting from single manufacturing facilities to multi-factory in order to gain competitive advantages in the international economic arena. The objectives are to adopt models of coalition of enterprises able to rapidly react and adapt to market changing requirements. Some example of new business paradigms have been proposed as Virtual Enterprises, Virtual Organization, Fractal Enterprises and extended enterprises. However, coordination models have to be identified within these organizations. The objective of this chapter is to review the literature related to the second level. The rest of this chapter is organized as follows. In Section 2 the methodology used to review the literature is explained. In Section 3, the review of the literature has been classified. In Section 5 the discussion of the literature with the future research paths are provided, Finally, in Section 6 the conclusions are discussed.

RESEARCH METHODOLOGY

The aim of this research is to classify cooperation in distribution production systems research conducted over recent years. Moreover, the research intended to identify the strengths and weaknesses of the literature themes investigated and the emergence of new themes, and trends in publication quantity. Articles for analysis were gathered from leading information system journals for the 5 year period 2004–2009 including the first part of 2010. The number of journals selected was to 115 containing coordination tool in distributed production systems. Table 1 reports the list of journals that contains at least two papers dealing with the coordination in distribution production systems.

The articles were searched within journal with impact factor and the identification of articles within the journal list involved keyword searches and an exhaustive search on contents pages of the journals. Articles that appeared to fit into the distributed production planning category were verified by firstly reading the abstract and then the entire article to extract the main findings and emphasis of the article. Moreover, the books
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