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A typology of the situations of cooperation in supply chains

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ABSTRACT

Pushed by globalization and its consequent increased competition, supply chain managers have understood the importance of information sharing, joint decision-making and cooperation across supply chains. Therefore, how to synchronize local activities through global processes and how to establish a collaborative supply chain relationship are actual difficulties that supply chain members have to address. In this context, this paper suggests a model of the situations of cooperation in supply chains for coping with real industrial situations, based on the analysis of the limitations of previous models. It is shown how the suggested model may allow to identify dysfunctions in the cooperation process, especially when both large and small companies are involved, and can also be used to describe and monitor the possible evolution of the cooperation process. Finally, the model may help to specify the way information should be efficiently processed all along a supply chain, depending on the situation of cooperation.

1. Introduction

In today's global market, it is a current statement that companies no longer compete as independent entities but rather as integral part of Collaborative Networks (Camarinha-Matos & Afsarmanesh, 2005), grouping entities for allowing them to seize opportunities to which a single partner could not answer alone (Msanjila & Afsarmanesh, 2010). Within Collaborative Networks, the manufacturing processes are implemented by supply chains. As also underlined in the generic case of Collaborative Networks (Afsarmanesh, Ermilova, Msanjila, & Camarinha-Matos, 2009), information sharing, joint-planning, cooperation and strategic partnerships over the entire networks are nowadays considered as conditions for building more efficient and reactive supply chains (see for instance recent surveys on this topic in Arkan and Hejazi (2012), Ding, Guo, and Liu (2010) or Cheng (2010)). In order to develop supply chains based on collaborative processes, a first step can be to implement "best practices" (O'Leary and Selfrifge (1998) suggest "promising practices" as a better term) defining the relationships between partners. SCOR (SCOR, 2008) is certainly the best-known and most widely used reference framework in that purpose. Nevertheless, working in a collaborative context is not only a matter of exchanging the right information at the right time: above all, it is a question of creating a favorable context, allowing deep commitment of all the partners in a climate of trust. The analysis of the quality of relationship between partners in a supply chain is therefore a key issue for implementing collaborative processes. As a consequence, academics and practitioners have suggested several typologies of situations allowing a better identification of the types of relationships between partners of a supply chain.

On the base of an analysis of real industrial situations of the aeronautical sector, we show that these typologies may have limitations in some real cases. With a specific emphasis on supply chains involving large and small companies, we so suggest a new typology which may allow to correlate identified situations of cooperation with the "best practices" often promoted in this sector. Especially, we show that usual "best practices" may be poorly adapted to some specific (but common) cooperation contexts. Therefore, classical cooperative processes (including information processing for planning) should be adapted according to the identified situations of cooperation. We suggest that this improved cooperation model may provide a support for diagnosis the relationship, but may also act as a guide for conducting a project aiming at managing the lifecycle of this relationship.

The paper is organized as follows: after having introduced the case of aeronautical supply chains, practical ways to coordinate partners in this sector are described (Section 2). In the third section, the factors influencing cooperation/collaboration as they are identified in the literature are analyzed, together with the typologies already suggested on their base. A dynamic model is then described, which better explains real cooperation situations as identified during interviews conducted in the aeronautical sector (Section 4). In Section 5, different ways to use this model are suggested, providing a first validation of its interest and relevance.

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2. Coordination of the partners in aeronautical supply chains

2.1. The case aeronautical supply chains

Developing more collaborative supply chains is considered as a key issue for improving performance in all the industrial sectors, but among them, the aeronautical sector has some specific interests:

- The aeronautical industry is a sector with high added value. This has allowed the actors of the sector to focus during many years on technical aspects, and to put the emphasis on high quality and innovation more than on prices. Nevertheless, competition has dramatically increased during these last years, and has motivated all the large actors of the domain to focus on their core business. As a consequence, the aeronautical supply chains have made in ten years what has been done in twenty in the automotive sector: supply chains have become rapidly larger and more complex, leading to the necessity to optimize their performance.
- A specificity of the aeronautical sector is the diversity of the exchanged materials and components: the quantities of products manufactured are of course much lower than in the automotive sector for instance, but the number of different parts in each product is much higher. As a consequence, many SMEs, created on the base of specific technical skills, are active in these chains, since they can provide a significant ratio of the load concerning a given material or elementary part.
- The role of the SMEs has changed a lot in the sector through time: some years ago, they were only subcontractors for simple operations, but since the large customers do not want anymore to process the material flow between their partners, these SMEs have now to manage their own suppliers. This is quite unusual for them, leading to the problem to master new tools and develop new skills in a short amount of time.

As a consequence, aeronautical supply chains are in a rapid evolution, and in comparison with other industrial sectors, have the additional difficulty of combining large and small companies, with very different cultures and levels of maturity in the technical and behavioral management of their own partners. Therefore, many projects aiming at better understanding and improving relationships and information processing in these supply chains have been recently launched.

2.2. Coordination of partners in aeronautical supply chains

Implementing standard and efficient processes is usually considered as a first way to insure coordination in a supply chain (Arshinder, Kanda, & Desmukh, 2008). Therefore, several reference models of the operational and business processes have been defined and promoted by various professional associations. The most common and recognized ones are certainly the SCOR model (SCOR, 2008) and the GSCF Supply Chain Management Framework (Lambert, 2008), while CPFR (CPFR, 2004) describes business practices based on such closer relationships. These models have different focus and industrial targets; however, they all suggest lists of processes considered as necessary for managing and synchronizing partners in a supply chain, through the optimization of the internal activities and an increased cooperation with the other supply chain members. The dissemination of these frameworks is therefore encouraged in aeronautical supply chains. In practice, the daily data processing and information exchanges required for managing a relationship will most of the time be performed by the information system of each company, and more precisely by ERP (Enterprise Resource Planning) systems (centralized systems like APS (Advanced Planning Systems – Stadtler & Kilger, 2000) are poorly adapted to the coordination of autonomous entities). Within an ERP, in the context of aeronautical supply chains as discussed in previous section (high diversity, large number of partners), production is most of the time managed using the MRP2 (Manufacturing Resource Planning) technique (Orlicky & Plossl, 1994), even if just-in-time techniques can occasionally be used for execution.

Using the MRP2 method, forecasts are gathered by a company and used as inputs for building a Sales and Operation Plan (SOP), often with a 1–3 years horizon in the aeronautical sector. A Master Production Schedule (MPS) is then be deduced at lower term. On the base of the obtained sequenced requirements on the final products, the bills of materials are used for generating on one side a Supply Planning, and on the other a Production Planning (Material Requirement Planning step). The adequacy between the load generated by the Production Plan and the capacity of the company is checked (Load Planning), then the production is scheduled, with a typical horizon of 1–2 weeks. Release and work in progress management can be done using classical methods, or using the Kanban method.

MRP allows to deal with complex bills of materials when the demand is known through programs, which is the case in the aeronautical industry. Therefore, Supply Chain Management is usually implemented in this sector through a cascade of MRP systems, one in each company (see Fig. 1). In this configuration, the supply plan of each company is used to create the forecasts sent to his suppliers. Considering Fig. 1 (and even if real supply chains have the topology of a network), it is clear that information can only be correctly propagated through the supply chain under condition that each partner, whatever his size or culture, is able to efficiently perform his local role concerning data processing.

It is shown in next section that this consistent management paradigm (business processes defined by reference models like SCOR, then implemented using the MRP2 production management method, supported by ERP systems) may be difficult to operationalize in practice, especially when SMEs are involved in the supply chain.

2.3. Specificity of the SMEs: a literature view

As seen in previous sections, the presence of SMEs in aeronautical supply chains can be explained by the diversity of the

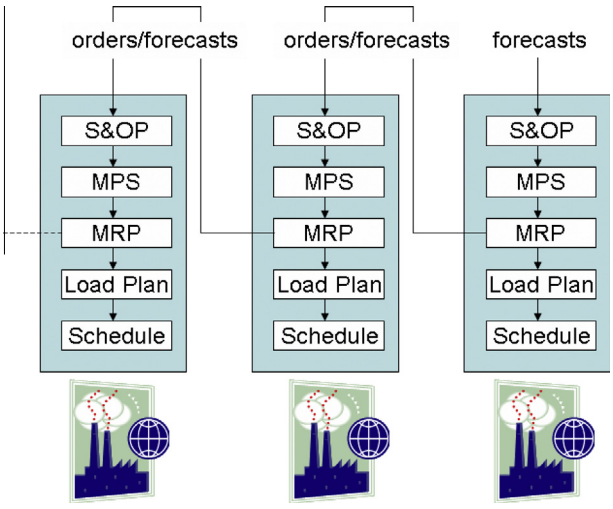

Fig. 1. Supply Chain Management as a cascade of MRP systems (Grabot & Mayère, 2009).