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Editorial: Supply networks design and management

Agostino Villa · Chris O'Brien · Partick Burlat

We are pleased to introduce this special issue of the Journal of Intelligent Manufacturing, dedicated to "Supply Networks Design and Management". It has been managed by Pr. C. O'Brien (England), Pr. A. Villa (Italy) and Pr. P. Burlat (France). This special issue is a post-conference publication, based on extended versions of selected papers from the proceedings of PROVE'06 Conference and INCOM'06 Symposium. It intends to present academic works and industrial applications about networks, where enterprises join together to achieve goals that they could not perform separately. Such cooperative behaviour aims to gain economies of scale, to propose global offers to final customers, to increase market shares, or to detect and exploit new opportunities by exchanging information and knowledge. Within networks, each firm is driven by a proper management, searching for local efficiency maximization, and balancing between the collective obligations and its own interest. Furthermore, networks are dynamic and complex forms of organization in the way enterprises can belong to different networks, and can join for a limited time period. In this context, a crucial problem is to design networks according to market needs rapidly and at low cost, and to assure efficient collaboration among the partners during the life cycle of the network.

The paper "An integrated methodology for the analysis of collaboration in industry networks" by D. Antonelli and B. Caroleo offers a reliable and unbiased method to identify and analyse collaborative patterns inside an industrial network. The proposed method uses a graph representation of inter-firm relationships inside a network and induces the presence of collaborative behaviours by the analysis of the graph topology. Cliques and quasi-clique mathematical approaches are used to detect and model potential collaboration among enterprises. An application is given to illustrate the potency of the analysis, and an extension is proposed by combining multiple graphs, leading to cross-graph-quasi-cliques so as to better formalize inter-firm collaboration.

A complementary point of view is given in "Modelling cooperation links within networks of firms: a case study" by M. Benali and P. Burlat. This work also provides a methodology to identify potential ties between firms within a network. It is based on theoretical approach taking in account structural characteristics of firms, such as complementarity of activities and similarity of competencies. Here again, graph theory is mobilized. Two organizational graphs are plotted: a map of potential coordination modes and a map of actual coordination modes. An industrial case of a network of 10 firms is presented to illustrate the method. Such cartographies help the enterprises managers to detect potential relations and to design networks. It also helps to evaluate the possible chance and/or risks of fusions within networks.

Shifting now to Supply management, the paper "Overall performance measurement in a supply chain: towards a supplier-prime manufacturer based model" by V. Cliville and L. Berrah gives a way to evaluate supply networks where the prime manufacturer performance is strongly dependent on the suppliers' behaviour. The approach is based on the SCOR model and the impacting supplier performances are integrated into the prime manufacturer thanks to a Choquet aggregation integral operator. The MACBETH methodology is used to coherently express both local processes and overall performances. This leads to a better understanding of the relationships between a main contractor and its suppliers within a supply chain. Here again, an application is given—this time with a bearing's manufacturer—to illustrate the proposition.

Supply networks management is addressed by K. Kogan and C. S. Tapiero in a different way in "Coordination of co-investments in supply chain infrastructure". The authors assume that the supply chain firms' capital consists essentially of an investment in the supply chain's infrastructure. As a result, firms' policies should focus on selecting both an optimal level of employment and the level of co-investment in the supply chain infrastructure. However, the usual non-cooperative behavior of supply chain parties reduces the efficiency of supply chains compared to centralized systems which maximize aggregate profits. Therefore coordination of co-investments in supply chain infrastructure is of a fundamental importance. The article proposes an approach based on the practice of creating a supply chain common funds (i.e. a supply chain shared capital with temporal reward or penalties) to ensure efficiency while keeping distributed decision making all along the chain.

Then, "A Lagrangean heuristic for a two-echelon storage capacitated lot-sizing problem" by S. Kebe, B. Penz and N. Sbihi goes more deeply into managing and optimizing the material flow a two-echelon transfer line supply chain. This article is issued from a real case where raw materials are sent by suppliers to a distribution centre and then transported to a unique plant where they can be stored. The problem is to meet the demand during the planning horizon while minimizing the global cost under storage and transportation capacities constraints. To do so, a mixed-integer programming formulation is presented and a Lagrangean relaxation solution procedure is proposed. Computational experiments are carried out to compare the performances of the given Lagrangean heuristic with an exact method.

"Optimal MRP offsetting for assembly systems with stochastic lead times: POQ policy and service level constraint" by M. Louly et A. Dolgui deals with managing supply networks where several types of components are needed to produce one finished product. Such assembly systems are operated thanks to a MRP approach. Here, the aim is to find the optimal MRP offsetting, considering that actual component lead times have random deviations, and shall

thus be considered as random variables. The proposed model and algorithms minimize the sum of the setup and average holding costs for the components, while satisfying a desired service level. This is a multi-period model with no restriction on the number of components and where lead time density function for each component may differ from the density functions of other components. All possible distributions can be used for component lead times. The decision variables are integer and represent the periodicity and planned lead times for components. The suggested model and algorithm can be used in many industrial networks where assembly is required.

Finally, A. Villa, T. Taurino, and W. Ukovich give a comprehensive synthesis of supply networks design and management issues in “Supporting collaboration in European Industrial Districts: the CODESNET approach”. Based on the capitalized experience from the CODESNET project (Collaborative DEMand and Supply NETwork), a previous EU-funded project, the authors motivate and present an enduser-oriented procedure for the performance evaluation of an Industrial District and for estimating the potential advantages of either a good coordination of—or a good cooperation among—the SMEs contained within the district under analysis. Here again, an application of the procedure is given with a number of industrial districts that have been analysed thanks to the CODESNET research program.

We would like to thank the authors for their contributions and the referees for the time they put in reviewing all the papers. Thanks to Professor Andrew Kusiak, Editor in chief of the Journal of Intelligent Manufacturing, and to Professor Gérard Morel for their support and the possibility to publish this special issue.