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New business models and configuration approaches for focused-flexibility manufacturing systems

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Abstract

In the current competitive scenario, industrial companies experience frequent unexpected changes in production demand. To cope with them, they often opt for investments in manufacturing technologies which embed extra-flexibility that is rarely utilized and that, consequently, penalizes financial and operational performance. In this paper, new business models for focused-flexibility manufacturing systems are proposed to improve manufacturing performances in turbulent environments and to increase machine builders competitiveness though the offering of high value-added services. These innovative business models should be enabled by the adoption of new integrated methods for the joint production system-business model configuration. Starting from the available state of the art on production systems configuration, the paper illustrates research activities in progress to finalize the development of such methodological enablers for new flexibility-oriented business models.

Keywords: New business models, Manufacturing flexibility, Reconfigurable Manufacturing Systems;

1. Introduction

The reduction of products lifecycle due to accelerated technological trends or to very fast market dynamics generated by modern consumption uses, can be the cause of frequent changes in the products characteristics and in the volume of demand. A fundamental key success factor, especially for manufacturers operating in sectors where turbulence is higher, is the capacity to rapidly follow unexpected market fluctuations in order to keep customers satisfied and to acquire the reputation of reliable suppliers. However, to reach these goals, they must rely on manufacturing technologies with the flexibility or re-configurability level that allows such rapid changes in volumes and features of the produced parts. Thus, the decision on the level of flexibility [3][13] and re-configurability of manufacturing systems is a key decision which can strongly affect company competitiveness. Typically, in fact, flexible manufacturing systems –systems that have the embedded potential to adapt to external changes- are expensive and less performing in case of volume productions, while reconfigurable manufacturing systems [7] –systems that have the enablers to be easily modified to adapt to external changes- present a lower initial investment cost but may require additional cost (and time) to be reconfigured, which could be not compatible with market requests [15].

To optimize the decision on the flexibility and re-configurability level of manufacturing systems, recent research proposed new system configuration methods based on stochastic programming that suggest the type and number of machines to include in the system layout in order to cope with the expected variability by optimizing cost functions [14]. These methods allow the configuration of the so called "focused-flexibility manufacturing systems", meaning with this that the system has the optimal flexibility level for the considered production scenario [11][12]. But how can these novel approaches be a valuable resource for manufacturing companies? Since they are the result of

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recent research developments, they are quite complicated from the computational point of view and are currently manageable only by expert researchers rather than manufacturing customers.

Furthermore, they take a dichotomic approach in which only the machine tool builder or the manufacturing customer perspective can be considered at the same time (by using objective functions maximizing machine tool builder profit or minimizing customer investment costs). Finally, these models consider mainly technology system and machinery-related variable, such as process feature, pallet time, tools, etc., while neglect wider costs and revenues at business level, such as financial, logistics, organizational and service variables.

Thus, in order to take advantage from the possibilities offered by innovative flexible and reconfigurable technologies and novel configuration approaches, an effort to shift at business model level the opportunities of manufacturing flexibility is needed.

2. New business models for focused-flexibility manufacturing systems

The business model can be intended as the definition of the main pillars of a company structure, which describe how it produces value for the market and how it remunerates its stakeholders. These pillars are the value proposition, the supply chain configuration and the revenue model [2][4]. The business model represents a valuable intermediate approach to implement company's vision and mission into detailed business processes and manufacturing technologies [9].

In this paper, we consider new business models for the supply and use of production capacity, with the associated implications for manufacturing customers and production systems suppliers. Based on the opportunities offered by novel flexible technologies and system configuration methods, two innovative flexibility-oriented business models are proposes and are below discussed.

They were conceived after a case study campaign investigating new business model needs and opportunities in the machine tool sector, which involved a production system supplier, a machine tools components supplier, a service engineering company in the machine tool industry and a manufacturing end-user in Italy. The two business models were contrasted by machine tool builders and system suppliers in order to verify their applicability and industrial interest.

2.1. Reconfiguration guarantee business model

In this business model, the system supplier tailors the flexibility level of the production system on the forecasted customer's demand, without adding extra-flexibility whose future utilization is uncertain. By using approaches for focused-flexibility system design, he identifies the possible future reconfigurations that might be necessary to customer in function of future demand scenarios.

Besides providing the so-optimized manufacturing system to the customer, the system supplier also states in the contract the economical conditions that will be practiced for the forecasted future reconfigurations, if they will be requested by the customer. The main contractual variables which are object of negotiation between customer and supplier are the production system price and the price for future reconfigurations. The role of customer an supplier in the lifecycle phases is represented in Fig 1.

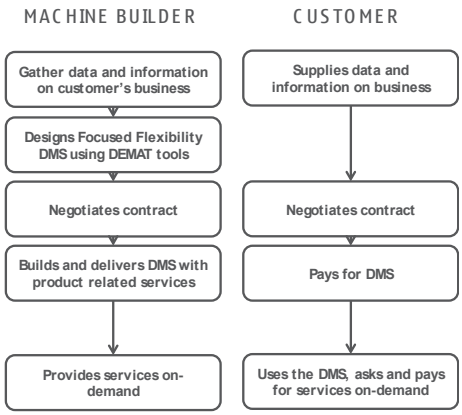

Fig. 1. Role of customer and supplier in "reconfiguration guarantee" business model (DMS stands for "Dematerialized Manufacturing Systems", Demat is the NMP-246020-2 FP7 EU project)

In this business model, the system supplier would sell reconfigurable machines with limited flexibility, with consequent renounce to higher initial incomes and postponement of cash flows, which are uncertain because they will depend on the real happening of forecasted demand. Thus, from a financial point of view, the business model might appear pejorative for the supplier.

However, if customers will recognize the advantage of this innovative value proposition, supplier's turnover will grow thanks to the acquisition of new customers that will chose them, leading to a marketing benefit. In addition, suppliers will establish long-term relationships with customers, which will allow a better understanding of market need and a privileged position to promptly satisfy them. Despite marketing benefits, depending on market response and to his commercial strategy, also from a financial point of view the supplier might decide to ask for a margin premium for the focusing-flexibility service he offers and for the advantage generated to customer.