Enterprise Integration and Economical Crisis for Mass Craftsmanship: A Case Study of an Italian Furniture Company

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Abstract. The paper presents a real industrial case of an Italian furniture company facing the problem of a strong evolution put by the market-scenario during the economical crisis. The new challenges to face come either for earn margins reduction, increase of customization level, swift of demand fluctuation. The aim of the paper is to provide a clear analysis of the existing problems and constraints, in the light of the project to design the transition toward a new-defined "mass craftsmanship" configuration of the company.

Keywords: Enterprise Interoperability, Information Modeling, Mass craftsmanship.

1 Introduction

The term ''mass customization'' was first coined by Davis (1987) in his book Future Perfect [1]. Mass customization is presented as one of the ways to deal with the increasingly demanding and turbulent environments. Based on the rapid obtaining of mass customization (MC) demanded information from the consumers, and market changing information, MC product agile manufacture is to develop new products in responding to the consumers' demands and to guide the markets via agile organization management, agile design and manufacturing. Achieving mass customization requires the development of multidimensional strategic capabilities: how to deal with the contradiction between scale production effect and customized demand is the key problem on studying mass customization. Mass personalization is the limiting case of mass customization [2]. Whereas both of these strategies are guided by the criterion of product affordability consistent with mass production efficiencies, the former (mass personalization) aims at a market segment of one while the latter (mass customization) at a market segment of few. Mass Craftsmanship (MCMS) here referred to is an hybrid form between pure mass customization and mass personalization, since it is possible – thanks to the retail chains available at the present in the furniture segment – to address a wide marked but of singular requirements. To a certain extent, the intuition of this new kind of market descending from the crisis times, where customer are still demanding for personalization and fashion but are less available to pay for the

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value added. MCMS should be thus an opportunity to respond to this changed customer demand while maintaining good profit margins. Products are deeply customized according to the single customer but, at the same time, manufacturing and assembly schedules should try to see it as a standard product, to gain advantage of efficiencies proper of a mass production. Different than a do-it-yourself setting (i.e., autonomous creation activities of consumers), this is done in a mode of interaction with the manufacturer who is responsible for providing the custom solution ("co-creation,") [3].

This is, shortly, the position of the problem the Italian furniture company here addressed, facing the strong transition from a quite stable market situation toward an unstable situation due to the economical crisis experienced in the Euro-zone. We will concentrate on the software part of the solution of the business-process reengineering process. The most of the approaches presented above share the same features, which can be easily recognized as critical to the present study: the need to integrate information, to reduce loss of it and efficiency – as well as efficacy – in its use. Fragmentation of information, interoperability of different IT applications as well as univocal semantic interpretation of knowledge are critical in the mass customization paradigm. The stronger thus it criticality for the new mass craftsmanship paradigm, which increases the demand for a clear view of job assignments. These points will be further developed in the following paragraphs.

2 The Case Study

The sector of furniture, at least in Italy, is characterized by a relative product complexity with an high changing of the demand pattern either in volume and/or in product models over time. This leads to an extremely volatile market, which is also affected by the ever-decreasing profit-margin problems. Competition is thus based on anticipating the customer desires as well as in challenging appealing prices to customers which are even less available to spend their money, due to true or perceived crisis time. The challenge for any company is to increase the worthiness of money spent by customer, by providing the tacit benefit of fashion while maintaining an high levelof quality and service. The mass craftsmanship paradigm (MCMS) is here addressed as the natural business strategy to simultaneously compete on these rival competitive priorities, descending from Mass Customization [4].

The Italian furniture company under analysis lives in the situation above described. It produces kitchens for the private sector since 1987. It has grown from a small company up to a medium-large company in the south of Italy, with around 2 weeks delivery time, mainly for the Italian market. Approximately, the company works with more than 30.000 component variants (which is not unusual for a modern mass customization manufacturing process (see, e.g. [5]).

In the last years it has experienced a strong increase in its production volumes, leading to a threshold situation where all the inefficiencies and criticalities in the managerial decision became evident. The call for a change management derived from this situation.

Amongst all, the two most critical issues recognized by the management are: i) stratification over time of a mass of different IT applications that, despite coming

from the same supplier, presents significant inefficiencies in integration and data synchronization; ii) difficulties in maintaining the adequate degree of operational flexibility of the small artisan size with the increased demand in terms of volumes and variety.

These two strong challenges unfortunately, but obviously, negatively impact with the presence of consolidated craftsmanship habits from the organizational point of view. This last attitude, on the other hand, is also a success factor of the company, since furniture market – at least in Italy – is mainly a "market of one", where personalization is critical to the customer. It it thus mandatory for the company to maintain his craftsmanship behavior; this is thus the true challenge to face at the present time of analysis of the system.

3 The Enterprise Integration Analysis

The key step to find an enterprise integration solution is to follow a structured path. To this aim, in the present study we adopted the HY-CHANGE© methodology [6]. The choice descends from a comparison with other approaches (as presented in [1]) where, despite the similarity in the structured approach, the HY-CHANGE structured hybrid methodology for Continuous Performance Improvement provides multiple perspectives of analysis.

3.1 Push Event (WHY)

The present market scenario of furniture industry in Italy shows a increase in fragmentation of orders, characterized by an rapid changing variety of modular components - at the same time with swift change in customer's demands for aesthetics and excitements such as domotic applications. At the same time, profit margins are continuously reducing with also a potential reduction of overall selling volumes. This evolution, which belongs also to the multicultural evolution of society with respect to the previous decades, is partially interpreted by a growing phenomenon of big selling centers, collecting single customer demands while trying to influence the market orientation with a selected offer of models and varieties. Nevertheless, customers demand is fragmented for cultural and social reasons, highly customized but at the same time – by the nature of this market – it is the same customer the "designer" of the product (co-creation). This is essentially the main issue to face: how to take into account the variety of customer requirements - from higher quality to high fashion products - even though there is not an design expert when issuing an order. The most of the problems, in fact, typically born in the product specification phase, which is coincident with the order collection from the vendors collecting personalization desire but with few experience of production and/or assembly. To make this furniture scenario more complex, is the 'lower cost economy' where customers are extremely exigent but at the cheapest price: this is the true challenge for manufacturers and assemblers to win the present crisis competition. Italian furniture scenario is thus urging – much more now than ever- new answers, asking for a significant reshaping of the organization endeavoring the mass craftsmanship paradigm, which can be sometime a

critical demand for most of the players. Reengineering business processes thus is a must to be pursued, do readapt to this changing reality.

It happens quite often that, due to the fragmented customer demand profile, a constant dynamical rearrangements of orders is required, urging sometimes for rush orders that requires a flexible but effective dynamical adjustment of the scheduling. Information management is thus vital in this process, since availability, forecasts as well as technical information should be perfectly integrated as it was for the craftsman in the past.

This picture represent the "push event" that motivated the company to ask for a business process re-engineering action to be designed and implemented. The feeling that "something was going wrong" pervaded the company in the last years, either in the disorganization evidences or in the overall profit lowering. To summarize, the push event was a psychological feeling of confusion in the organization, that brought the employees to distrust the management actions.

3.2 Preliminary Study (WHAT)

According to interviews and brainstorming, it emerged the need to define a new "mass craftsmanship" paradigm, to produce personalized products to meet each individual customers needs but with mass production efficiency. Expected results from these were recognized into an higher flexibility to adapt customer's demand patterns as well as maintaining a reasonable level of remuneration by cutting non-value added activities and inefficiencies. An implicit goal, that may result from implementing changes according to the above mentioned goals, can be the proneness to innovate product anticipating customer tendencies: reorganization of company may in fact release resources of creativity.

Information and its correct flows play a critical role for controlling either order, production planning, manufacturing as well as delivery operations. The implications derived from the drastic increase of varieties, very small batch size, random arrival of orders, and wide spread of due dates are really impressive into the organization and operation of the company.

Existing strategies and solutions for facing enterprise integration are at the present time rarely implementable tout-court, provided the specific history of the company and its operating constraints. The organizational functional areas involved into this change process are commercial one, technical/design one, production planning and control and finally logistic. Production, in the very first phases of change are not directly involved, if a proper policy of push of orders and pull of expedition is set up in the other areas.

3.3 Analysis of the Existing Situation (WHERE)

For the sake of the present paper, we will focus only on the software aspect of change; we will thus concentrate on information flows. The information can be in fact viewed as an organizational resource [7]. Each task within an organization, has a management content and, as such, manages information [8]. Therefore the information is a

cross-function resource. It is an intangible asset and is the root of all other intangible organizational resources such as knowledge and individual and organizational experience. Unlike other resources that tend to run out, the information is self-regenerating and its use often increases its value [7].

Actually, the computer system adopted throughout the company can be said to be tied to the history of the company; i.e., the IS that makes use of technological HW/SW resources has different approaches depending on the functional area of pertinence Our case study is characterized by the presence of a legacy computer system that consists of a fairly diverse set of applications that have been layering over time as a set of solutions to particular problems and, despite being largely supplied by a single software provider, show high levels of inefficiency resulting from low levels of integration and interoperability. For this reason the level of integration doesn't allow us to say that we have a real IS for the integrated management of business processes. The IS structure looks like what is depicted in the following figure 1:

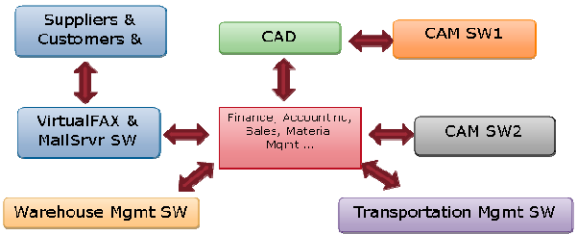

Fig. 1. Schemata of the IS in the Italian furniture company

The approach that has been followed to analyze the existing situation is to represent information flows using a standard tool (see, e.g. figure 2). The main goal was to appreciate the functioning of the legacy system with the aim of appreciating interoperability features of the set of IT applications represented in fig.1.

Lying behind this picture there is a major obstacles to a correct interoperability in our case study, represented by existing SW solutions poorly adapted to interoperability because of their stratification over time. This is a major problem recognized, since the design of SW solutions rarely is able to cope with future interoperability requirements, coming from new SW solutions or applications. In this cases, SW provider is often a strategic asset to work with, since it can maintain the memory of the IT solutions adopted and can guarantee the co-design or co-evolution of the IS.

Externalization of IT solution means to realize the strategic importance of cooperation with the IT provider over time. In the present paper we present an example of the order flow analysis. The chosen notation to represent the order process is BPMN that is an OMG standard described, for example, in [9] and [10]. Figure 2 presents a high level order fulfillment diagram.

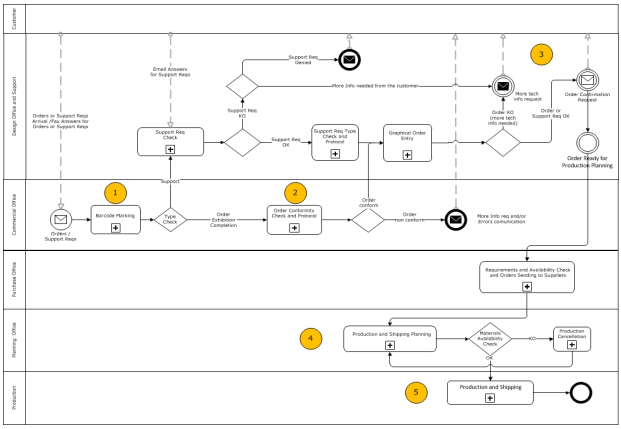

Fig. 2. BPMN representation of the As-Is information flows

It is evident that the leading criteria behind the criticalities recognised are mainly improvement of performances (key-performance indicators) as well as the efficacy of the management action over the system.

Solutions here proposed are initial ones, since the BPR is still on-going and the effect of potential improvements (as those commented in the following paragraph) are still far to be raised on the field.

4 Plan of Improvement (WHEN)

The solution here initially proposed was to synchronize the technical solutions here listed, for managing the production and the information, with a correct organizational approach aiming at integrating the company view and its supply chain. Basically, these analyses were performed according to the IS alignment approach proposed in [11], namely: alignments with the strategy, with the environment and with the uncertain evolutions. We considered the IT strategy into account as a standalone domain required to align IS.

The temporal dimension is taken into account by considering the pattern of "Past / As-Is + Next-Step / To-Be" scenarios that constitute the temporal evolution of the IS as a function of the remaining variables.

The approach developed to face the existing organizative/IS problems is similar to the "classical" alignment path in which the business strategy is the anchor domain and drives both the design of the organizational infrastructure and processes and the design of the IT infrastructure and processes.

The alignment path could be assimilated to a sort of a blend of the approaches MIT90s and BALES [36] and is described by the following figure:

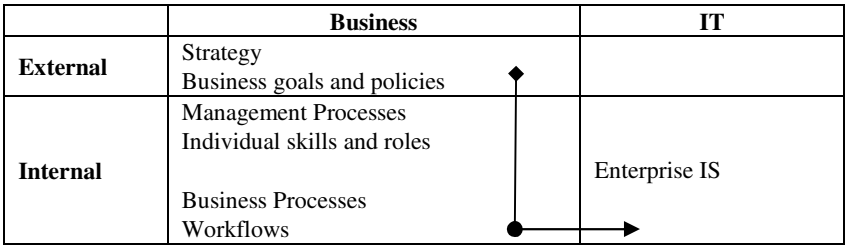

Fig. 3. Graphical representation of the "involved domains" and "alignment sequences" for the developed alignment approach

The key factor for the change is represented by the strategy and the pivotal domains are the Structure, the Management Processes, the Individual skills and roles and the Workflows. The impacted domain is the Enterprise IS.

To achieve the business change the idea is to adapt the existing enterprise model to reflect the new business reality and to determine a new mapping between the enterprise model and the legacy system.

4.1 Integration Model of Information

Customer co-creation is the central theme of mass craftsmanship. Quite often, through an interactive website, but also through telephone, the customer chooses a product configuration based on the offerings of a company. This seems to be the new challenge of the next years to come, at least in the Italian furniture sector. A very simplified version of the re-designed order fulfillment process is shown in the following diagram (see figure 4). The aims of the five introduced modifications are:

1. To partially automate the order arrival process
2. To simplify and rationalize the order entry process
3. To partially outsource the design process to the sales network provided that a CAD configurator is simply to use and the ability to configure kitchens following the final customer expectations is a typical task of the sales network
4. To simplify the task of the Planning Office letting it to concentrate on the container loading and transportation planning problems also moving downstream the issuing of the production and picking lists
5. To give the necessary flexibility to the production process by managing in the last-possible-stage the always up-to-date production and picking lists

The indicated numbers are respectively correspondent in the diagrams of fig. 2 and fig. 4, in the table 1 and in the above list.

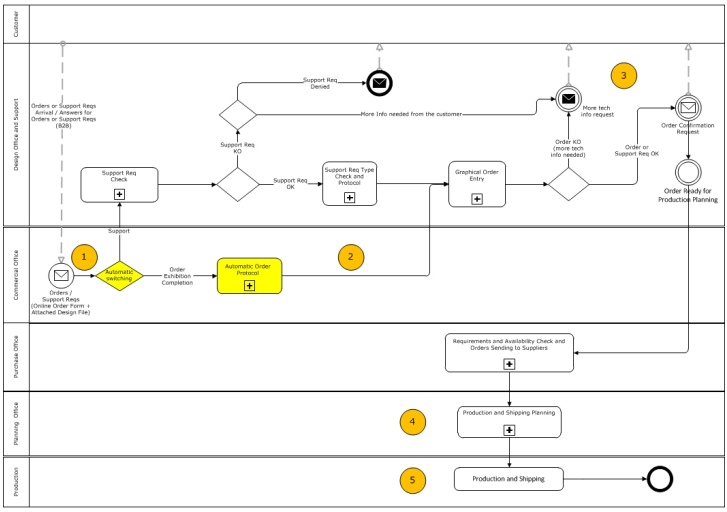

Fig. 4. BPMN representation of the proposed To-Be information flows

4.2 Merging Postponement and Push

Postponed manufacturing is where product components are standardized into generics and mass produced for global markets. The big challenge for the Italian company under study to react swiftly to market demand is a proper balance between good level of stock of standard components, while providing a really fast response to customization for only a small part of customized components.

A clear analysis of the customer order decoupling point was made (see definition in [[12]]), then realizing the critical situation of a mixed push-pull production due to order collection system. CODP is mainly at vendor chain level, i.e. far from the true action radius of the company. The idea of a Virtual Customer Decoupling Point (VCDP) was thus initially explored. The aim was to see if it was possible anticipating the market orientation, on the basis of an effective and well connected chain of vendors and in-house retailer. VCDP can be the good idea of creating a virtual stock holding point that separates the part of the supply chain that responds directly to the customer from the part of the supply chain that uses forecast planning.

This idea will be explored in practice in the course of the project. To this regard, we wish to highlight two fundamental issues concerning the IS, which allow to achieve the described purposes. The IS must first present the highest possible level of inner integration and cohesion, and moreover the boundary that defines the separation between what is well integrated and what's not has to coincide with the boundary of the enterprise. This means that the "legacy" issues must address the relationship of the enterprise with its customers and suppliers rather than the relationship between the various departments / functions of the enterprise itself as it occurs now.

Table 1. Detailed description of the proposed modifications

N	Office	As-Is	To-Be
1	Commercial Office	Receives oders in a virtual fax/mail server. Both fax and emails (and their attachments) are barcoded. Barcoded documents are then passed into the management system	The order (management data) is filled in online (B2B) and the design file (graphical data) is correspondingly attached. All the information are immediately recorded into the management system.
2	Commercial Office	Order protocol Commercial conformity check of the order: - OK: furniture design development by the Design Office - KO: communications with the customer to correct the order	Commercial conformity check of the order (B2B): - OK: Order protocol and furniture design development by the Design Office - KO: the customer must re-send the complete, correct order
3	Design Office	Develops the furniture with the CAD configurator and sends the confirmation / more info needed request to the customer	Technical conformity check of the order: - OK: Order Confirmation Request and Order Ready for Production Planning - KO: more tech info needed. The customer must re-send the complete, correct order
4	Planning Office	Generates the production plan based on the carrier cargo volume, geographic area and availability of products. Print the production and picking lists and the packaging labels	Process the production plan based on container loading constraints and geographical constraints of transport.
5	Production	Production based on production planning	Production based on production planning Print the production and picking lists and the packaging labels

4.3 Community of Practice

In today's competitive environment, the ability to transition to an improved enterprise is a critical discriminator. The reference model of social learning systems will benefit and shorten the training time to equip novice knowledge managers and personnel with the required knowledge to practice the construction of an effective social learning system. This is a very critical point that will be addressed in the next phases of the project, according to the model presented in [12]. Implementing a model of social

learning within the company reality is a challenge, due to non favorable structural as well as social context. Mass craftsmanship production processes require substantially higher worker skills compared to homogeneous mass production processes: the social process is thus much more important than ever in this context.

4.4 Lean-Manufacturing

Lean manufacturing principles can be easily applied to situations with low levels of MC. However, as the degree of customization increases and customer involvement occurs earlier in the design and fabrication stages, the direct application of lean principles to maintain flow and low levels of inventory becomes difficult. It is clear that lean production provides a base for mass customization: this is one of the key merging points between technical solutions and organizational one. Without a strong commitment of the company to the zero-defects culture no chance at all is possible to perform an effective transition toward mass customization.

5 Discussion and Conclusion

The paper presents the first outcomes of a project under development for supporting the transition of an Italian furniture company toward a new equilibrium of mass customization. The analysis show that it is not easy at all to merge technical and organizational aspects in the current hybrid situation, due also to the need of change of mentality and practices.

At the root of the metamorphosis required also in the furniture sector, as well as in many others sectors, is the customer of today who is itching to express his or her personality through personalized products, but is restricted by the size of the purse.
This is not yet the case of furniture sector, but software product line will result a very clear and interesting idea to explore in order to bring a true innovation for the Italian furniture segment.

As a final remark, mass craftsmanship is a new paradigm here introduced is a strategy susceptible also for a possible relocation of production processes through extremely low worker wages. Particularly, mass production processes seem to be highly appropriate for a relocation, provided an adequate IT structure is working.

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