



CLUSTERS AS A WAY OF REALISATION MASS CUSTOMIZATION APPROACH

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Abstract: Companies are constantly asked to improve performances in order to get the chance to retain or to improve own market position and financial situation. Market requirements in the 21st century are revolved toward big variance of products and services, so the company can not rely on cost reducing strategy, applying mass production of small number of products. Instead of that, company has to find way to produce as big as possible quantity of products (per customer requirements), with less costs. The problem can be solved by networking in the cluster. Cluster can be known as a competitive cooperation in the purpose to gain higher level of competitiveness and success.

Key Words: Clusters, Production management, Flexibility, Mass customization, Holistic approach

1. INTRODUCTION

Clusters are big systems suitable for applying MC concept, because they consist of more SMEs and other subjects from supply and value chain. This system has productivity, flexibility, volume. But there are some problems and one of them is Production planning and organization in one such as system.

Important rising of competitiveness, that is predetermined by intensifying globalisation process, require from companies to get closer to customers through the increasing market segmentation. Companies are constantly asked to improve performances in order to get the chance to retain or to improve own market position and financial situation. Market requirements in the 21st century are revolved toward big variance of products and services, so the company can not rely on cost reducing strategy, applying mass production of small number of products. Instead of that, company has to find way to produce as big as possible quantity of products (per customer requirements), with less costs. Realisation of that requirement means constant changes in technical-technological sense, also in all processes in the company.

In modern global economy, companies are facing everincreasing challenges for short time-to-market to

enter into the market early, for reduced time-to-volume to occupy the market quickly, and for decreased time-to-profit to get return from market shortly. These business requirements drive technology needs (Cambridge, 2004) to speed up product development (CIMdata, 2004) to enhance manufacturing and supply capability and capacity, and (Georgia, 2004) to improve revenue from lifecycle efficiency. Business world of the 21st century witnesses an expanding global competition with increased variety of products and low demand. Old manufacturing technologies fail to meet the increasing demand for customization production. On the other hand, increased product variety, customized and instable product designs, and international competition lead to the development of new manufacturing technologies. Productivity, quality, and flexibility are critical measures of manufacturing performance for justifying the investment in manufacturing systems. Flexibility is the key concept used in the design of modern manufacturing systems.

Piller (2005b) defines mass customization as, “*Customer co-design process of products and services, which meet the needs of each individual customer with regard to certain product features.* All operations are performed within a *fixed solution space*, characterized by stable but still flexible and responsive processes. As a result, the *costs associated with customization* allow for a price level that does *not imply a switch in an upper market Segment.*” Tseng and Jiao (2001) define mass customization as, “technologies and systems that deliver goods and services that meet individual customer’s needs with near mass production efficiencies.”

The product variety management should be effectively put into operation in today’s world. Today’s high product variety environments come not only with the higher number of differentiated products with higher number of design changes but also with higher variations in demand and lower volumes of production. We believe that the new era of higher product variety environments should be analyzed together with all the associated costs.

Big companies have advance because they can alone finish production cycle, regarding all production process participants are in the company, they can produce

optimal series with lower production costs. Their problem is low level of flexibility. On the other side, small companies are flexible, they can easily change production programmes and satisfy individual customer requirements. But they depend from other companies in the value chain and have increased production costs.

The problem can be solved by networking in the cluster. Cluster is known as a competitive cooperation in the purpose to gain higher level of competitiveness and success. They have positive characteristics of small enterprises, and at the same time they act as huge systems. Production process, purchase, engagement of experts are done together, with flexible specialisation concepts applying. So, problem of customization and fulfilling requirements of individual customers is transferred to problem of management of production on cluster level.

Clusters and networks are evidently effective tools in industrial development policy that are used by developed and undeveloped countries to seek for social and economics objectives and increasing of SMEs competitiveness. If SMEs are in undeveloped region they have to improve their competitive edge and to integrate into world market more efficiently. After that, they have to strike down big obstructions which were generated by competition, market requirements and insufficient capital base. Among a many constraints are also difficulties with information and financial resources and inability to satisfy customers requirements about scope and quality. In order to strike down these difficulties and to improve their competitiveness, SMEs have to seek for cooperation inside production and value chain. That means, that this cooperation have to consist of suppliers, customers, competition, maintenance services and other similar industrial branches.

Effectiveness of Industrial cluster depends on effectiveness of each element – factor, i.e. on processes in clusters and how firms operate together as one whole.

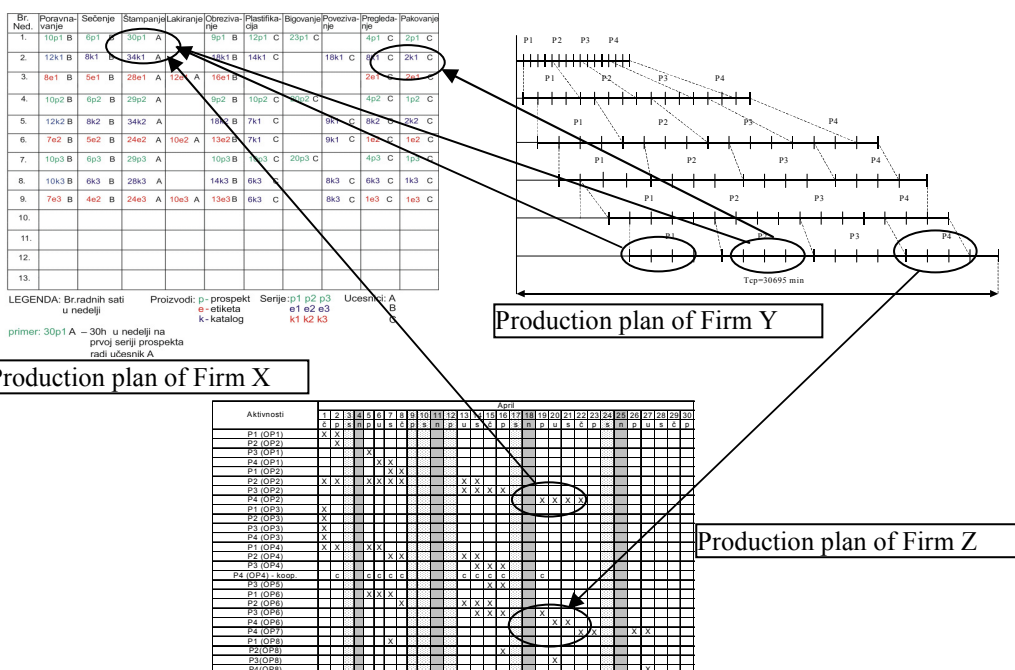
That means that there is no division on more important and less important processes and elements Only logical solution is division of rules and processes to cluster members in whole. In generally, in firms exist processes that are directly and indirectly involved in creating new value. That means, that production function directly act on creating a new value but all other functions are logistical support. Integration in system have to start with detailed analyse of production process and activities and than connection with other functions should be done.

2. PRODUCTION PLANNING IN COMPLEX STRUCTURES

Manufacturing systems are becoming increasingly complex because growing requirements both for productivity and flexibility. This complexity is more evident when dealing with big manufacturing plants where the usual control requirements are met by centralized systems that are too rigid and hard to manage, maintain and update.

If we consider big systems, clusters or agglomerations needing for holistic approach is much more conceived. Major procedures in process manufacturing management are consisted of programming procedures (validation interdependence between system and environment), planning, analyse of procedure of situation change. It is clear that industrial systems are under the constant impact of dynamic environment and obstructions in processes, that results in complex management procedures. If system structure is more complex than management processes are complex too.

Special environment requirements, obstructions in processes, late delivering, organizations weakness and similar impacts cause needing of operating plans adjustment in time of their execution. Needing of operating plans adjustment is constant, because of constant changes in real time. Deviation from plans cause deviation in results.



Picture 1. Integration of production plans

Here is illustrated what does this concept mean: We suppose that firms X, Y, Z are cooperating. Firm X supplies (raw materials and components) from firms Y and Z, and firm Z supplies from firm Y. If we want to apply holistic approach, it's considered that every firm has developed management production system and that at the beginning of making operating plan for next period has correct time schedule for all processes in a firm. Plan of processes can be illustrated through matrix (firm X) or through Gantt chart (firms Y and Z). See picture 1.

Major problems which cause planning need are:

- Fulfilling of delivering terms
- Unfinished production control
- Minimizing of waiting queue,
- Optimizing of work order in process
- Balance of capacity
- Integral system support
- Balance between stock costs and production continuity
- Ensure current assets

Holistic approach enables to firms to plan and execute their processes, adjusting them to the requirements and possibilities of their business partners. So, firms in cluster can expect important benefits, and some of them are:

- higher competitiveness,
- reduced operations costs,
- expand market share,
- standardization,
- higher productivity,
- diffusion of technological knowledge and innovation and
- increasing flexibility.

Participation on market cluster can greatly improve the profit margins of member firms through a variety of savings, the development of a business strategy and the achievement of targeted markets. Within cluster, members share administrative and promotional costs and thus avoid some expenses. By jointly using transportation and other facilities, additional time and cost savings can be achieved. In addition, cluster help their members to move from simply supplying products to customers ("reactive" marketing strategy) towards developing a particular strategy for special markets, where marketing activities can be extended and technical specifications or prices are not simply prescribed by clients ("active" marketing strategy). A more coordinated and market responsive approach to a specific market can thus be developed. When several enterprises join forces to promote their market access, they increase their bargaining power with distributors and buyers. In some cases, the cluster may even be able to develop its own distribution channels. Intermediaries, on which small firms often rely excessively, can thus be avoided and the profitability of the firms' operations improved.

Manufacturing system oriented to mass customization implies use of layout and governance

such to allow an easy and fast inclusion of a new product within the family of products under manufacture, and a simple modification of the manufacturing process in front of the market-requested product innovations, such to minimise the cost for product inclusion.

This task is particularly important in a Network of Small-Mid Enterprises (SME), where a large effort is necessary to coordinate

1. the definition of the necessary modifications of the working sequence (which should be applied in the different SMEs of the network, depending on their specialisation and the phases of the product working sequence they are able to implement),

2. the innovation of the existing pattern of production flows among the various SMEs.

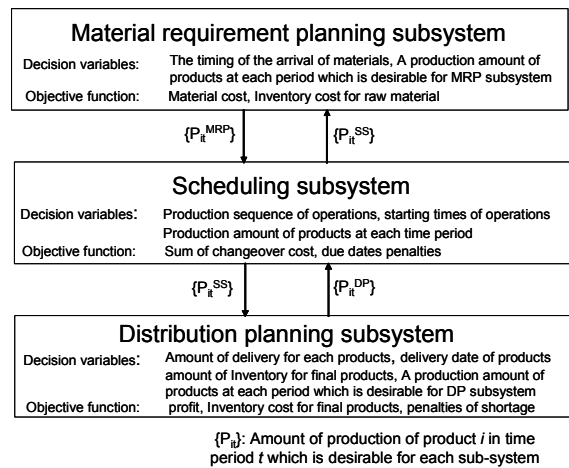
For MC concept implementation are necessary flexibility and economy of scope, financial resources, HR. But in cluster, we have all of these predictions, because cluster consists of firms which are different towards size, branches, level of flexibility and so one. In cluster is possible for MC concept apply.

Mass customization starts from understanding customers' individual requirements and ends with a fulfillment process targeting a particular customer. The achievement of time- to-market through telescoping lead times depends on the integration of the entire product development process spanning from customer needs to product delivery. Boundary expansion and concurrency are the key to the integration of the product development life-cycle from an organizational perspective. To this end, the scope of the design process has to be extended to include sales and service. On the other hand, product realization has to satisfy various product life-cycle concerns simultaneously, including functionality, cost, schedule, reliability, manufacturability, marketability and serviceability, to name but a few. A main challenge for today's design methodologies is to support these multiple viewpoints to accommodate different modelling paradigms within a single, coherent and integrated framework (Subrahmanian et al., 1991). In other words, realization of mass customization requires not only integration across the product development life-cycle, but also the provision of a context-coherent integration of various viewpoints of the product life-cycle (Newcomb et al., 1996). It is imperative to employ a suitable product platform with unifying product and/or product family structure models to serve as a coherent integration mechanism for the common understanding of the general construction of a product, thereby improving the communication and consistency among different aspects of the product life-cycle.

3. CLUSTER STRUCTURE

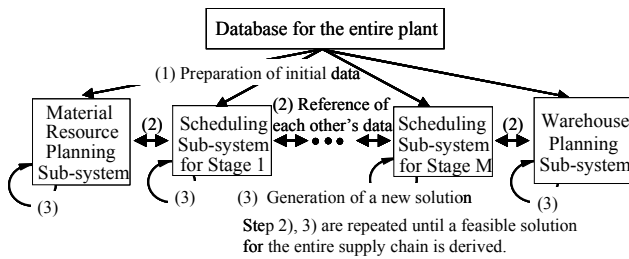
The structure of the system is shown in picture. 2. The total system consists of a database for the entire cluster, a material requirement planning subsystem (MRP) and some scheduling subsystems (SS) for respective production stage, and a distribution planning

subsystem (DP). The purpose of the MRP subsystem is to decide the material order plan so as to minimize the sum of the material costs and inventory holding costs of raw materials. The SS subsystem determines the production sequence of operations and the starting times of operations so as to minimize the changeover costs and due date penalties. The purpose of the DP subsystem is to decide the delivery plan of each product so as to maximize the profit including inventory costs for final products. The model structure of the decentralized supply chain optimization system is shown in Fig. 3. Each sub-system has own local decision variables and an objective function. The decision variable and the objective function at each sub-system are also denoted in Picture. 3.



Picture 2

All cluster members have a right to plan own production, but if we consider integrated system (cluster) we have to plan and manage common production by Planning centers (for MC implementation).



Picture 3

Description of events	Planning center which announces the job		Other Planning centers
[a] Order is needed, announce job to other Planning centers	Job Announcement Planning center	→	Job Reception Planning center
[b] Job Reception Planning center relays the job to Bid Evaluation Planning center			↓
[c] Other Planning centers are considered to submit a bid			Bid Evaluation Planning center ↓
[d] Other Planning centers submit a bid according to their own conditions	Bid Reception Planning center	←	Bid Evaluation Planning center
[e] Deadline for bid submission is reached (no more bids will be accepted)	Bid Reception Planning center		
[f] Notify Job Award Planning center		↓	
[g] Job Award Planning center sends offer to other Planning centers according to the ranked bids	Job Award Planning center	→	Bid Evaluation Planning center
[h] Acknowledge of job offer	Job Award Planning center	←	Bid Evaluation Planning center

4. CONCLUSION

In this case, when we talking about applying MC concept in clusters, production planning and realization are not very complicated. Why? First of all, in cluster, we have completed chain for product, we have firms which are specialized for some product parts, and we have condition for organized and »just in time« production. Then, we can manage from Planning Center who distributing and attending requirements, tasks and deadline for job realization.

As we told, clusters have a many advantage for applying MC concept, and we need to support and help a cluster establishing and development in our country.

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