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Production System Concept for Implementing Mass Customization Strategy in Furniture Industry

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Abstract

This paper presents a production system concept for implementing mass customization strategy in furniture industry. The developed concept represents the characteristics of the European and Bulgarian furniture industries as well as the globalization's impact on the furniture industry. The suggested production system concept is based on the development of organizations through partnership and the development and application of a strategy for mass customization in contract manufacture. The suggested conceptual solution for establishment of Suppliers Park would have a great importance for the Bulgarian furniture industry because each time more Bulgarian furniture enterprises turn to the idea of founding a contract manufacture. The suggested decision is a stage in a research project between Technical University Sofia and representatives of the Furniture Cluster in Bulgaria.

Key words: Mass Customization, Furniture industry, Suppliers Park, Contract Furniture

1. INTRODUCTION

Europe is the leading furniture market in the world and realized more than half of the global furniture export. Nevertheless, the furniture industry in the EU loses its international competitiveness. Each time greater part of the production is exported through outsourcing in countries of Eastern Europe. This fact is a good opportunity for the Bulgarian furniture industry.

The Bulgarian furniture industry demonstrates a growing trend for the last years but the Bulgarian furniture enterprises have low innovations potential. They tend to imitate the foreign products instead of developing their own design of furniture and to renew them constantly. The majority of the Bulgarian furniture enterprises are still competitive because of the low cost of the end products and the short delivery period.

The main problem of these enterprises is the poor organization of the management and the insufficient qualification of the human resources. Due to the fact that the Bulgarian furniture enterprises operate in different specific conditions, it is hard to achieve their cooperation through participation in various industrial clusters and industrial districts.

In the contemporary business environment the only chance for survival of the Bulgarian furniture enterprises is the achievement of flexibility in relation to design and costs of the furniture.

Furniture industry is among the ones in need of immediate transition from mass production to mass customization. This fact is due to the specificity of customers' demand which decreases considerably the

size of the manufactured products' lots. The furniture manufacturers should pay more attention to the variability of the manufactured products while at the same time keep low cost production. Therefore becomes imperative the achievement of process manufacturing flexibility as well as manufacturing the end products in close cooperation with their suppliers. Implementing mass customization strategy aims to achieve long-lasting customer satisfaction while at the same time keeps high manufacturing effectiveness. In this case emerges a contradiction between great product variety and low manufacturing costs. The current paper aims to develop conceptual solution which will minimize this contradiction in the conditions of the Bulgarian furniture industry.

The main objective of the present work is to define the concept and general characteristics of the mechanism for implementation of flexible cooperation between the furniture enterprises. Through these instruments should be overcome the problems of the Bulgarian furniture industry mentioned below.

The mechanism should achieve the objective of a research project between Technical university – Sofia and the Bulgarian furniture cluster, namely – achievement of sustainable competitive advantage of the furniture enterprises in accordance with the Bulgarian environment.

The present work suggests such mechanism in the form of Subcontractor Park. The paper describes the initial phase of the scientific research project. In the second phase of the project on the basis of the developed concept for Subcontractor Park will be worked out a hierarchic system measures for evaluation of the sustainability of

the furniture enterprises willing to participate a park. In the third phase of the project through the hierarchic system measures for evaluation will be explored in details each of the furniture enterprises.

For the achievement of the so defined purpose a group of problems are resolved. They are structured as sections of the present work.

In section 2 are analyzed the main characteristics and weaknesses of the European furniture industry. In section 3 is presented an analysis of the Bulgarian furniture industry and the characteristics of the Bulgarian furniture enterprises. In section 4 is analyzed the impact of globalization on the furniture industry. In section 5 are analyzed the problems of the global supply chain management. In section 6 are analyzed the opportunities for development of the furniture enterprises through different forms of partnership. In section 7 are analyzed the opportunities for development of the furniture enterprises through application of various strategies for mass customization. In section 8 are presented the main characteristics of contract furniture and the advantages they may ensure to the Bulgarian furniture enterprises. In section 9 are presented the main characteristics of the developed conceptual solution for the establishment of a supplier park for production of contract furniture.

2. CHARACTERISTICS OF THE EUROPEAN FURNITURE INDUSTRY

The European Union is the world's biggest region for production and consumption of furniture. It holds about 36.5% of the world's furniture manufacturing and will keep the increasing trend over the next years [1]. Italy, Germany and Great Britain are the greatest furniture manufacturers, holding almost 51% of the common EU production. Europe is a leader in the furniture industry long before USA and even before the countries in South-Eastern Asia. The EU holds more than a half of the global furniture export. However, the EU furniture industry loses its international competitive advantage and part of its internal and external markets [2].

The lower manufacturing incomes in some countries are connected with the transfer of the manufacturing centers and location of the companies. A high percentage of the EU manufacturing is transferred in the Eastern European EU member states or other countries mostly in Asia. The outsourcing to some non-European countries is the main reason for the decreasing competitive advantage of the European manufacturing.

These changes make obvious the general trends in Europe: the international competition in the furniture industry will become stronger in future; the pressure for development and restructuring of the European manufacturing areas will remain a long-lasting trend. This structural change should be directed towards important spheres like: qualification, quality, development, innovation and service in order to highlight the already existing advantages [1].

3. CHARACTERISTICS OF THE BULGARIAN FURNITURE INDUSTRY

Furniture manufacturing in Bulgaria is less developed in comparison with the European economy. Nevertheless, the Bulgarian furniture industry continues its trend of growth [3]. The sales volume in current prices amounts to around 1,125 billions BGN (13,5% increase compared to 2008). The manufactured production in 2009 (according to preliminary data) increases with around 19% compared to the previous year and amounts to 1,4 billions BGN [4].

The furniture producers are concentrated in specific regions: Troyan – Teteven; Veliko Tarnovo; Velingrad – Peshtera – Batak; Burgas; Blagoevgrad – Razlog – Bansko; Smolyan; Chepelare and Ruse. The territorial distribution of the furniture producers provides conditions for future development of clusters [5].

Despite this, the labor productivity in the furniture manufacturing is lower than the average for the manufacturing industries. Compared with the average productivity levels in the EU, Bulgaria falls behind. The local productivity is more than 9 times lower than the one in EU [6]. This fact is due to the high levels of using of manual labor in the solid wood furniture manufacturing and the production of specialized items with too outdated technologies.

The Bulgarian enterprises have low innovative culture. When speaking about innovations they refer to new technologies and don't pay enough attention to the importance of the process innovations [4]. A large number of the Bulgarian enterprises in the furniture industry are market competitive thanks to the low end product cost.

The majority of the small furniture enterprises in Bulgaria manufacture mostly for private consumers which characterizes the dominant production in our furniture industry. In addition to furniture manufacturing on demand these enterprises supply components and accessories for medium and large furniture enterprises. These enterprises are equipped with universal production equipment for furniture production and have difficulties to survive in the contemporary economic conditions because of the low efficiency of their activity.

Some medium furniture enterprises, having contracts for subcontracting with small furniture enterprises, offer them also unique furniture designs. They produce furniture also for large-scale interior projects. The lack of optimization of the manufacturing processes is a typical characteristic of this kind of enterprises. This is the main reason for the inefficient utilization of the production capacity.

The basic problem of these enterprises is the lack of management coordination, which would make possible the development of an effective business system. In these enterprises the managers are engaged in almost all tasks related to the business. It can be noticed some deficit manufacturing equipment and technical knowledge, that makes them dependent on other enterprises.

Generally, the problems related to the small and medium furniture enterprises could be classified in three groups: supply with materials and components; production; marketing.

Supply. The slots of a business system are materials, energy, finances and technical knowledge. Not all of the raw materials and components are produced in Bulgaria and the imported ones are of poor quality due to their low cost.

Manufacturing. The technological processes for product manufacturing are characterized by low productivity of the production systems and low qualified work. The majority of small and medium furniture enterprises need qualified collaborators, like operators, engineers and designers.

Marketing. No marketing research is held and therefore most of the furniture manufacturers are incapable of exporting their own products mainly due to the lack of collaborators and export organizations.

The greatest weakness of the Bulgarian furniture manufacturers compared to the furniture importers is the lack of distinguishable brands and potential for renovation and modification of the products. At the same time strength of the furniture manufacturers is the low cost and the possibility for prompt work out of the orders. This is valid also for the other countries in Eastern Europe [7].

The manufacturers would rather imitate some existing foreign products instead of develop their manufacturing and marketing. In these enterprises the product development is not perceived as competitive advantage and doesn't have any active market role. Since the different groups of enterprises produce furniture in specific for their size technical and organizational conditions, they are unable to achieve beneficial collaboration in between themselves.

4. IMPACT OF THE GLOBALIZATION ON THE FURNITURE INDUSTRY

Many researches of the scientific literature and trends prove the heavy impact of globalization on the furniture industry all over the world [8,9,10,11,12,13].

By globalization we understand the escalating integration of the national economies into a united global market economy. This trend changes the competitive conditions because new actors appear and the traditional roles in the industrial enterprises should be redefined.

Globalization changes the structure of the labor-based industries, among which is furniture industry. The increased import caused by the lower prices forces the European furniture manufacturers to look for new forms of competitive advantage and to restructure their business.

As a whole the impact of globalization on the furniture industry is beneficial. Nevertheless, in short term the effects are not always positive and in long term this might affect the sustainability of this sector.

The low production costs of the Asiatic enterprises by no means engender redirection of the furniture production centers.

Despite this, globalization changes the relationship between raw materials suppliers, manufacturers and distributors. Suppliers gain higher bargaining power because of the raw materials shortage. This fact causes costs rising. On the other hand, distributors also gain higher bargaining power, because they may import cheap end products from the Asiatic countries instead of buying from local producers.

Another key aspect stemming from globalization is the homogenization of customers' habits and preferences. Being aware of the consumers' perceptions in the other sectors as well as the world's trends, establishes a view of furniture styles, which may be created in each and every part of the world.

What should be done in today's furniture industry is overcoming the old traditional business models of the furniture producers and forming new business identity of the manufacturers. There is a great diversity of ways to do this: transforming the manufacturers in distributors; elaboration of the activity of the market related organizations; vertical integration of the organizations, etc. each of these changes presupposes a deep change of the existing business models in the furniture industry.

A key factor for the achievement of sustainable competitive advantage by the furniture manufacturers is the combination of efficiency and business differentiation. The strong customers' orientation together with the constant satisfaction of consumers' needs and expectations helps for the development of really differentiated products.

These aspects should be included in the strategic reasoning of the top managers as well as in the strategy development of furniture enterprises.

Having in mind the current situation, it should be bared in mind that the really important innovations begin with a precise formulation of the organizational strategy. With an open mind, perceiving changes as something natural, there should be continuous effort for development of a dynamic organization, constantly capable of adapt to the environment.

5. MANAGEMENT OF THE VALUE CHAIN IN FURNITURE INDUSTRY

The popularization of the concept for value chain is perceived as a key element in development strategies in conditions of low growth.

In the contemporary globalized world where the mutual dependence is stronger, the regional business communities are linked in a dynamic business environment and so many objectives should be reached, the concept of the so called „Global value chain” presents a good view when we study the economic activity of scattered but closely related business units.

The supply chain is can be defined as a grouping of business organizations which exports goods and services on the market [14] or as the whole multitude of interactions between suppliers, manufacturers, distributors and customers [15]. A considerable part of the publications, treating the so called „Global supply chain” are concentrated on the material product flows through the chain [16,17,18].

Due to the fact that as a result of the interactions between suppliers, manufacturers, distributors and customers we add value to the material objects, in the strategic management publications the supply chain is often referred to as value chain or demand chain [16].

Gereffi et al. [17] present five types of management of the global value chain: hierarchical; overtaking; based on relations; modular; market. These types range from high to low levels of coordination and asymmetry of the influence applied. The structure of the global value chain strongly depends on three variables: business complexity; ability for coordination of the transactions; characteristics of the supply capabilities basis. The global value chain mechanism is strongly affected by some economic preconditions related to the transactional costs [18].

Furniture manufacturers are part of customer droved value chains. In these chains there are at least two kinds of sustainable coordination: vertical integration; modular coordination. The management of chains, based on vertical integration is applied mostly to expanding organizations, while the modular coordination is applied for international trade chains (like IKEA).

The customers oriented furniture value chains are guided by actors situated in the final links of the value chain. Retail may be characterized with considerable penetration barriers, engendered mostly by the need to place the brand successfully, to provide a wide range of service for the consumers and to organize product promotions.

On the Bulgarian furniture market are implemented three alternative mechanisms of the value chain management: market oriented; hierarchical; modular.

The market oriented management mechanism is inherited from the period of the planned economy. In this mechanism some independent furniture manufacturers supply their products to independent wholesalers and market chains. The business puts severe requirements to the furniture suppliers in this segment. Key factor for a competitive advantage are the manufacturing costs and the opportunities for renewal of the products are paid considerably less attention.

The market segments which have hierarchical or modular management systems demonstrate rapid growth rate over the last years. The comparative advantage of the modular system is due to the higher business flexibility of the organizations. The intense competition between rivals (especially the ones that are not vertically integrated) creates a situation where the main means for establishing discipline in the modular organization is the possibility for termination of the contract (termination of the orders from key clients).

Manufacturers, who are part of vertically integrated or modular nets benefit from different stimulus and advantageous opportunities to implement various strategies for business elaboration.

The stimulus for modernization of value chains with vertical or modular structure may be stronger as a result of the intense competition but the resources for modernization are usually limited because of the fact that the production of furniture components and the furniture assembling are among the least beneficial links in the value chain. In a nut shell, without improvement of their activity through repositioning in the value chain the Bulgarian furniture manufacturers will have to make their improvements on based on cost minimizations.

The vertically integrated manufacturers who expect to improve their activity through relocation in the value chain are focused on the renewal of the product lines and aggressive marketing strategies. At the same time insufficient is the attention paid to the optimization of the marketing processes and the cost management problems.

The competitive advantage of the Bulgarian furniture manufacturers remains insignificant. It is a common truth that the deterioration of the Bulgarian furniture enterprises competitive advantage is mainly because of the inadequate functioning of the final links in the value chain – from the end product producing to the end consumer.

6. DEVELOPMENT OF THE ORGANIZATIONS THROUGH PARTNERSHIP

With the exception of the Italian and Danish furniture producers, European manufacturers don't cooperate between each other [4]. In Italy and Denmark may be observed considerable success because the applied methods are cooperation between the different manufacturers as well as subcontracting.

In the contemporary business environment the Supply chain should be carefully considered. In the area of contract furniture creation are developed different forms of subcontracting on the basis of clever interpretation of the understanding for supply chain. There are efficient processes for analyses of the furniture supply chain.

The advantages of the outsourcing are well known. The furniture manufacturers have exported many activities through outsourcing. The outsourcing of activities may be applied also for parts of the manufacturing processes. The outsourcing is always based on firm decisions and deep analyses of the organization and its environment. Therefore, the decisions having to do with outsourcing are strategic decisions.

The most important reason for applying outsourcing is the reduction of costs. The organizations willing to implement alone the whole activity need more time for research, development, marketing and landing of the products on the markets. The achievement of more effective organizational structure through including of external suppliers and the benefits provided through the

specialization are among the obvious technical reasons for applying outsourcing.

When the business organizations resort to specialized subcontractors, they have access to their investments in technologies, methods and collaborators. These are long-term investments. Despite gaining competences by the subcontractors the business organizations get experience in the relevant area for their future work with clients and similar search situations.

For short period the organizations applying outsourcing become more dynamic and open for changes in order to be able to face the changes stemming from the current economic situation.

Today, the investment risks of the organizations are huge. The markets, competition, laws, financial conditions and technologies are changing very fast. It's difficult to be aware of the changes especially when they include considerable investments in resources. When outsourcing is applied, the risks are shared by several organizations. The specialized supplier doesn't invest for one organization only but for all his clients. When investments are shared, the risks for the individual organization are reduced.

Nevertheless, the outsourcing brings many threats. The responsible managers should be informed what was executed wrong and what measures should be undertaken to reduce the risks of errors.

The large distances and high communication costs when working with subcontractors require a completely new set of management methods.

The furniture industries, working on activities at the end of the value chain are more inclined to take part in different forms of business partnership. In spite of the increasing global competition, the size and structure of furniture producers remain intact by the growing tendency for vertical integration which may be noticed in the other industries. For the furniture producers economies of scale and economies of scope remain limited. In the Furniture industry there are still many small and medium enterprises, (specialized component suppliers, as well as end product producers), which have not only business commitment along the value chain but also horizontal interweaving [19,20,21].

To a large extent the business commitment rests on the cluster organization of the markets. In furniture like in all consumers' goods, the costs are important. The increasing global competition of the price basis forces the furniture producers to seek for cost efficiency. At the same time globalization allows the organizations to follow the world markets and search for the standard components suppliers, who offer lower costs. For activities that have to do with reduction of costs furniture manufacturers use market links which aren't local but encompass many territorially distant producers. In order to evade the severe cost competition most of the EU furniture manufacturers apply strategies focused on market segments which are less cost sensitive [20].

Furniture producers should offer each time wider diversity of models. In many cases they should customize their models even for individual consumers. In addition to this furniture manufacturers should be capable of fast and effective delivery. The delivery deadlines shrink from months to weeks because there is no delay tolerance on the side of retailers neither on the side of end consumers. In other words, the competitive advantage in furniture industry is more than ever based on the capability of the organizations to deliver greater product variety while supporting high efficiency of the manufacturing resources and efficient time management.

For the majority of furniture manufacturers this is achieved through development and support of flexible relations with specialized suppliers. The ability to communicate in a prompt and clear manner with various suppliers gives an opportunity to the end product producers to combine raw materials and components of different sources as well as delivery furniture with diverse characteristics (mass customized products) with delivery deadlines, which are considerably shorter than the ones of the world's big chains of producers. The flexible vertical links are supported by not so frequent horizontal flexible links where the organizations make orders in between each other.

In order to support minimal delivery times and high flexibility the organizations form different forms of clusters where the organizations are constantly interrelated in the form of vertical and horizontal flexible links. Each organization is supplier in some occasions and consumer in others.

Furniture industry in the EU is composed of many clusters. The Manufacturers or assemblers of end products and manufacturers of components for the end products are regionally grouped in industrial parks. Some of these clusters are situated in regions with long lasting traditions in this sphere like Italy for example [22].

In this type of furniture clusters the short operating times and low transport costs ease the vertical as well as the horizontal links for flexibility achievement (application of the manufacturing strategy Just-in-Time), but the most important benefits from the participation in clusters are the free links. In the furniture districts the free links in the professional associations allow frequent contacts between managers and operators. Despite for lowering of the operating costs, the free links help for reduction of the transactional costs on the basis of elimination of the transaction mediators. The free links facilitate also the transfer of knowledge – another important factor for competitive advantage in the furniture industry. The contemporary markets in the sphere of furniture require constant product innovations.

7. DEVELOPMENT AND APPLICATION OF A STRATEGY FOR MASS CUSTOMIZATION

Mass customization today is one of the leading strategies for customers' satisfaction and for ensuring

the survival of the business organizations in the contemporary environment.

Mass customization aims the efficient and effective satisfaction of the needs of the individual consumers. When the consumers are treated as individuals some characteristics which are not obvious like personal preferences, acquired needs and perceptions become integral part of the construction of the manufactured products.

In order to survive in the contemporary environment and to satisfy the each time more requiring consumers, the business organizations often apply strategies for mass customization. Through these strategies they manufacture personalized products at the cost of mass products. Mass customization is performed through agile balanced diversification of the products as well as of the processes.

Having in mind the increasing interest in maximization of the added value when manufacturing products, mass customization turns into strategic decision for achieving sustainable competitive advantage. The dominant practice for customization is to define the models of customers' needs in relation to specific product families and to develop simultaneously common for the families functional blocks and assembly units as well as modules of the manufacturing process for the development of these blocks and entities. In this way different elements of product design and elements of the manufacturing process could be used many times for the satisfaction of the needs of each consumer [23, 24, 27].

The products occupy central place in the value chain. Purpose of the collaboration with the business partners is to provide to the consumers products adding value for the consumer as well as for all the links in the value chain. An effective value chain always begins with precise development of product design.

The most important difference between marketing and mass customization is the accounting of customers' experiences not only when they use the products but also when the products are purchased, when the clients' orders are processed, the products are supplied, installed, fixed maintained or destroyed. Despite the products' functionality, customers' perceptions (experiences) throughout all these phases are crucial for the achievement of sustainable customers' satisfaction. The spreading of added value beyond the materially based functionality and achieving intangible customers' experiences becomes popular in many industries.

One of the successful methods for realization of mass customization includes six stages [25]. On the first stage is defined the scope of customization like combination of values and products specifications which should be covered. Secondly, objectives are defined which have to do with costs minimization. On the third stage are defined the regimes of management of the products' diversity (settings of the products; combinations of modules; dimensional customizations, etc.). On the fourth stage are defined levels of customization and manner of customization for each of

the levels. On fifth place, are defined methods for multi-leveled optimization. On the last – sixth stage is implemented the optimization itself. The main advantage of the method is the effective use of costs as well as its applicability to searches of various characters.

The planning of the process platforms is equally important to the planning of the product platforms because the product customization leads to exponential growth of the variations in the manufacturing system viewed from equipment standpoint, tools and operators [26]. Despite this the main part of the costs comes about in the manufacturing phase and the main component of the lead time is also in manufacturing phase. This necessitates a precise management of the process variability. Many publications treat the development of process platforms [24, 25, 26, 27]. Qiao et al. [28] suggest three approaches for coping with the problems in manufacturing systems. These approaches lead to the realization of mass customization. The first includes development of general line manufacturing platform, which allows reconfiguration. It covers mobile and reconfigurable work centers and flexible transport equipment. The production line saves time and expenses because only insignificant relocations of the work centers are necessary. The second approach includes the development modular production line, which is a grouping of functional manufacturing modules which may be synchronized and combined in order to create certain customized product. In the third approach through means for exchange of information are made in real time the reconfigurations of the product line on the basis of the customization data for each product.

8. DEVELOPMENT OF CONTRACT FURNITURE

If we summarize the results of the analysis presented in sections 2 and 3 of the present work, we may conclude that in the contemporary business environment of the Bulgarian furniture industry there are no chances for the achievement of sustainable competitive advantage when manufacturing furniture for housing. Therefore, other options should be researched like the production of contract furniture.

One of the fast developing sectors of the Bulgarian furniture industry is the development of furniture for interior architectural projects. In these projects in spite of the elements of the interior like integrated elements, wall panels and lighting, furniture is included as well.

Some authors name this furniture "Completion of the interior" and define it as contract furniture. The type of contract furniture depends on the needs of the end consumer – whether the furniture will be used for offices, exhibition areas, hospitals, schools and universities, hotels and restaurants, etc. In the EU Germany is the biggest producer of this kind of products, followed by Italy. The furniture of hotels, banks, and public buildings are produced by a network of medium furniture producers, who perform the manufacturing, as well as the design of furniture.

The production of contact furniture is an important business. For example in Britain the markets of this kind

of furniture are estimated on about 2.3 billions of euro on retail price [11]. More than half of these products are for the equipment of hotels (here are included also restaurants and places for entertainment). The contract furniture segment has perspectives for considerable growth. For Great Britain in this sector are engaged over 500 companies and over 90 000 collaborators, including architects and designers.

In its essence the contract furniture is not furniture designed for housing needs. This is furniture for state institutions or for companies providing various services like: accommodation, hotels, restaurants, hospitals, schools, etc.

The notion „Contract” stands for the existence of written contract between vendor and consumer for the supply of specific products. This furniture is manufactured on request of professionals in the public and private sphere. Therefore, this type of furniture is with modern design with higher quality than the furniture for housing needs.

The main characteristic of the contract furniture is its longer endurance than other kinds of furniture. This makes it slightly more expensive as well. The main advantage of the possession of this furniture is that it provides high quality for longer periods of exploitation. This compensates the higher expenses for its purchase. When such furniture is purchased the customers have in mind the character of service they provide and the number of people that would use the furniture. On second place they consider the type of the materials used, the competence and image of the producer. The purpose is to make a contract with the best in the industry so that the most effective solution is obtained at minimal costs. For this reason when such contracts are made should be clarified questions like: materials invested; style and design of the furniture; maintenance; accordance with standards; manner of installation and supply; clients' recommendations; way of payment, etc.

Contract furniture is characterized with considerable strength which is main requirement when furniture is used for professional needs. When furniture for professional needs is produced, the quality, duration and comfort are more important than the cost. If we use cheap and uncomfortable furniture for business needs there is a greater danger of destruction and vandalism.

Therefore, the main characteristics of contract furniture should be: duration; stylish design; perfect quality; safety standards; conditions for supply and installation.

With contract furniture the high quality and duration are generally achieved by using more durable raw materials but the style and design of the furniture are also essential. The plain furniture is usually manufactured by old fashion materials, mainly solid wood. In the modern design solutions should be applied modern materials like metal, glass, plastics, stone and ceramic elements, etc.

The decoration of contract furniture should also be different because the colors have strong impact on the furniture users. Bright colors corresponding to the relevant interior should be applied.

Often, there are several orders for contract furniture. The hotel chains for example order for their new hotels furniture identical with the one applied in the design of the other hotels of the chain.

Contract furniture is usually ordered in considerable quantities with the purpose of buying the products on lower prices.

9. CONCEPTUAL SOLUTION

For the solution of the problem, the author has led multiple discussions on the causes of the problem and on possible solution ideas with 11 managers of Bulgarian enterprises from the furniture industry. The results of these discussions are documented in 6 reports which were used as a basis for development of the requirements for the production systems in the furniture enterprises.

As a result of these analyses of the European and Bulgarian furniture industries and the trends in the contemporary business environment was reached the conclusion that the only possibility for achieving of sustainable competitive advantage of the Bulgarian furniture enterprises is their participation in the global supply chains which manufacture contract furniture. The Bulgarian furniture cluster includes 21 important furniture producers and has considerable experience in manufacturing furniture for hotels and offices of leading European companies. In spite of the positive results of cluster's activity, there are still many problems related to the coordination of the common activity of the participants in the cluster and to the manufacturing costs.

The main advantage for the participants in the cluster is the modern manufacturing systems, developed on the basis of controlled systems. Nevertheless, an important problem which remains unsolved is the lack of centralized system for manufacturing planning and scheduling. The result is lack of regular rhythm in the load and work centers and periodical delay of the supplies. This causes customer's dissatisfaction from the cluster's clients situated in various centers of the European continent. Another meaningful problem is the shortage of qualified collaborators for the management of the computer controlled system, as well as of engineers for technical support of the customers' orders. Inbound and out bound logistics are also weakness of cluster's activity. To a large extent these disadvantages have limited the clusters' activity only to the level of one designer bureau, in spite of the fact that there is growing interest from various designer bureaus in Europe.

All this leads to a centralized decision in which the different participants in contract furniture manufacturing should be treated as subcontractors not as associates. The activity of these suppliers should be planned and managed by centralized system for operations management. For minimization of the manufacturing costs maximum exploitation of the limited qualified human resources, the selected on the basis of complementary competences suppliers should be situated in industrial park.

These two rather complicated problems could hardly find solution through the traditional engineering methods and therefore, the USIT method is applied (Unified Structured Inventive Thinking) [29] as the main process for problem solving. The discussions at the initial stage may be summarized in the style of Problem Definition in USIT.

Analysis of the problem situation: At this stage of the problem solution different flexible methods are used. The analysis has passed through the following logically arranged stages: analysis of the special and temporal characteristics of the manufacturing system; analysis of the existing manufacturing approaches; exploration of the general structure of the problem; exploration of the essence of the problem; grouping of the elements of the manufacturing system; defining the functional requirements for the manufacturing system; exploration of the resources and skills needed for the development of advanced manufacturing system; analysis of the resources redirection; defining the requirements to the planning and operational control of manufacturing process.

Generation of ideas and concept formulation for the solution of the production system: Throughout the analysis, different solution ideas come about. Each one of them should be analyzed and the suitable ideas should be developed to the level of conceptual solutions. At this stage new approaches are searched, relating to the conceptual problem solution. The parameters of the new production system design, corresponding to the suggested at the previous stage requirements are defined on the basis of the author's conclusions after a number of discussions with managers of Bulgarian furniture enterprises. The suggested by the author solution for a production system design and the links between the different suppliers is presented on figure 1.

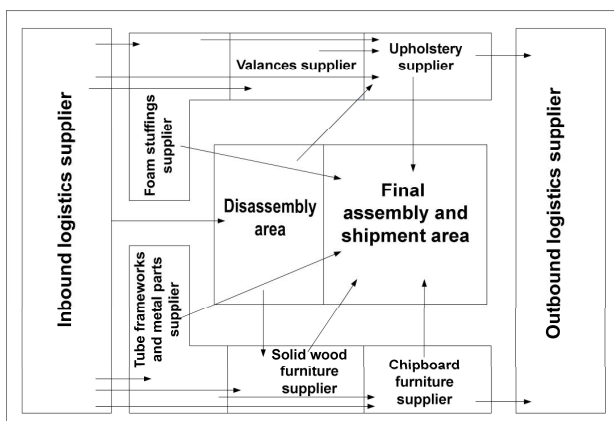


Figure 1. The suggested by the author solution for a production system design

As it may be seen from the figure, the suggested decision for development of supplier park is based on the common activity of seven suppliers (subcontractors).

This activity is planned and coordinated by one contractor who supports the contacts with the clients of the contract furniture. On the basis of the contracts with the clients and the obligations in them the contractor

elects top designers of contract furniture and reliable suppliers of raw materials and components. The main purpose of the contractor is to transform designers' projects into engineering solutions, which may be distributed between subcontractors in the supplier park. Another main obligation is planning and scheduling of the whole manufacturing process and its decomposition to orders (operational plans), delegated to the individual subcontractors according to the requirements of the relevant contract furniture construction. With the help of a manufacturing execution system (MES) the contractor controls the performance and the deviations from the plans for each subcontractor.

In the suggested solution for supplier park are included seven subcontractors with complementary competences: chipboard furniture supplier; solid wood furniture supplier; upholstery supplier; valances supplier; foam stuffing supplier; tube frameworks and metal parts supplier; logistics (inbound and outbound) supplier.

Each of the subcontractors prepares operational plans (for day or shift) of his activity based on the supply orders given by the contractor. In some of the models (products) of contract furniture the subcontractors develop on their own the end product and transfer it to the outbound logistics supplier. When this is impossible the end products are assembled in final assembly and shipment area of teams, composed of elected operators of the engaged suppliers. In some contracts there are clauses for promulgation of the delivered in the past contract furniture. In these cases the contractor plans the activity of the inbound logistics supplier to deliver following a precise plan the furniture to be promulgated (reconstruction of components and change of valances) and to direct them towards the disassembly area. On Disassembly area the teams, composed of elected collaborators take the furniture to pieces and send the parts to the relevant subcontractors, who perform the renovation according to the contractor's plan. During the periods when the manufacturing systems of subcontractors are not engaged with orders of the contractor, the subcontractors are free to have individual activity and benefit again individually from the services of the logistics (inbound and outbound) supplier.

The main advantages for the subcontractors when taking part in the supplier park are the reduction of the manufacturing costs on the account of the shared production infrastructure and collective implementation of the inbound and outbound logistics. Despite this each one of them resolves one of the serious problems – the shortage of qualified operators. Depending on the workload one and the same qualified operator may work as part timers for different subcontractors.

Generating ideas and development of concept for solution of the system for planning and operative management of the production. Without supply chain management (SCM), and possibility for forecasting the due date for expedition of the production results, the activity planning of the suppliers' park can't support the achievement of high competitiveness and sustainable growth. This is the main purpose of the suggested

production planning system. This system is based on the concept of the so called „Advanced planning and scheduling” (APS). On the one hand, the system is used for planning of the activity of the whole supplier park as level of the dynamic supply chain. On the other hand, it is used for the park’s units: subcontractors, manufacturing systems; work centers.

Synchronization of the planning: In the suggested planning system the synchronization is achieved in two directions: potential for comprehensive planning of the material demand; common for the whole park schedule which measures the production systems loads and all subcontractors in time; construction of the production schedules and subcontractors with calculation of the due dates on the side of external for the supplier park suppliers and vendors, subcontractors, outsourcers, etc. The production schedules for these two elements of the manufacturing system of the supplier park are mutually related with time, because they are derivatives of the master schedule for the activity of the supplier park as a whole.

Efficiency of the planning: The planning efficiency in the suggested APS system is based on its ability to define promptly the precise due dates for each client order. The efficiency in counting the deadlines in the APS system is based on the efficiency in the schedule for dispatching control, generated by the manufacturing execution system (MES). Through the MES system is imported the current data for emerged restrictions like: non-observation of the supply deadlines by the business partners, unexpected time-outs and delays, changes in the schedule of the clients orders, etc. In addition to this, the reporting of internal disturbances from the production systems of other subcontractors (defected equipment, rejection of the production, etc.) make the dispatching and its planning considerably more complicated.

10. DISCUSSION

The analyses of the condition and characteristics of the European furniture industry demonstrate that there exist supply chains and tendency towards outsourcing of more and more manufacturing activities to countries in Eastern Europe. This is an opportunity for development of the Bulgarian furniture industry.

The Bulgarian furniture industry possesses enough potential for furniture production at low costs and short implementation times of the customer orders.

Nevertheless, because of its insufficient marketing and innovation capabilities, the Bulgarian furniture enterprises can’t establish successfully on the market their own brands; neither can they renovate their product lines. Therefore, in the contemporary business environment the only winning strategy for them may be development through business partnership.

However, the research data shows that due to the considerable differences in their manufacturing processes the Bulgarian furniture enterprises operate unsuccessfully in various forms of partnership like

industrial clusters and industrial districts. At the same time there are many examples for successful participation of Bulgarian furniture enterprises as subcontractors in different global supply chains.

The suggested conceptual solution for establishment of Suppliers Park would have a great importance for the Bulgarian furniture industry because each time more Bulgarian furniture enterprises turn to the idea of founding a contract manufacture.

The present work reflects the activities and pre-project phase of studying the conditions for establishment of Suppliers Park in Bulgaria.

The next stage of the project will be to choose location of the park, suitable suppliers, selection of modern equipment, management software for planning and operative control of the whole activity of the park. After the selection of all necessary resources, a simulation model will be developed. It will present the park’s functioning, aiming to analyze the interactions between the different suppliers inside and outside the park.

There are many publications with scientific as well as with practical orientation, treating the development of furniture enterprises. However, all of them have to do mainly with industrial clusters and industrial districts. Suppliers’ parks are typical form of cooperation in the contemporary automotive industry. The present paper tries to extrapolate this good practice to furniture industry.

11. CONCLUSIONS

The suggested conceptual solution for establishment of Suppliers Park combines the good contemporary practices of the automotive industry. The suggested solution is directed to the establishment of contract furniture of a group of small and medium enterprises, but it may be used for the creation of other types of furniture as well.

What is more the idea of Suppliers Park may be realized with the participation of large industrial enterprises, as in the automotive industry. In this case the system of manufacturing processes planning would be much more complicated. Therefore, for the establishment of Suppliers park based on large industrial enterprises all risks should be precisely analyzed.

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Koncept proizvodnog sistema za implementaciju strategije kastomizirane industrijske proizvodnje u industriji nameštaja

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Rezime

Ovaj rad predstavlja koncept proizvodnog sistema za implementaciju kastomizirane industrijske proizvodnje u industriji nameštaja. Razvijeni koncept predstavlja karakteristike evropske i bugarske industrije nameštaja, kao i uticaj globalizacije na industriju nameštaja. Sugerisani koncept proizvodnog sistema je baziran na razvoju organizacije kroz partnerstva i razvoj i primenu strategije kastomizirane industrijske proizvodnje u ugovornoj proizvodnji. Sugerisano konceptualno rešenje za uspostavljanje Parka Snadbevača će imati veliki značaj za bugarsku industriju nameštaja zato što se svaki put sve više bugarskih kompanija za proizvodnu nameštaja okreću ka ideji uspostavljanja ugovorne proizvodnje. Predložena odluka je faza u istraživačkom projektu između Tehničkog Univerziteta u Sofiji i predstavnika klastera industrije nameštaja u Bugarskoj.

Ključne reči: Kastomizirana industrijska proizvodnja, Industrija nameštaja, Park Snadbevača, ugovorni nameštaj