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THE COMPATIBILITY OF EFFICIENCY AND FLEXIBILITY IN SUPPLY CHAINS: CASE STUDY OF AN INTERNATIONAL MANUFACTURING COMPANY

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ABSTRACT: *There are two basic peculiarities analyzing organizational capabilities of balancing efficiency and flexibility in organizational and organizational units' levels [34]: supply chain has more possibilities to increase flexibility not reducing efficiency than detached organization; organization as an individual unit has much more possibilities to increase efficiency in proper activities. The purpose of the article is to identify how the international apparel company is balancing efficiency with flexibility and what changes of this alteration were defined by the experience of the company during the past decades. The method of the research: scientific literature analysis, case study, action research.*
KEYWORDS: *flexibility, efficiency, supply chain, organization*

INTRODUCTION

The supply chain management is increasingly becoming of crucial importance for businesses seeking to increase efficiency and flexibility in all activities that are creating product value including the activity in the organization itself and partners' enterprises. While talking about coordination of efficiency and flexibility in supply chain it would be necessary to touch the activity of both the organization itself and its partners that are composing analyzed supply chain. Despite the fact that by increasing business value many organizations are searching for possibilities for increase of efficiency and flexibility becomes secondary [13], constantly increases the number of organizations that are choosing flexibility as the main instrument of competitiveness though [18], because it is flexibility that becomes the instrument of competitiveness in capture of parts of global market [10]. Also the tendencies of recent decade show that customers are demanding for bigger variety of goods proposed, possibilities of individual satisfaction of needs of particular customer [14]. Considering the fact that satisfaction of customers individual needs are disrupting efficiency [16], it could be stated that coordination of efficiency and flexibility is gaining importance in activity of both the supply chains and organizations. These challenges force organizations to become more flexible, adapt not only to global market in regard to prices and term, but to adapt to the changing demand in the market also. But if we can make a statement that efficiency is demoted to be secondary?

The most common direction of the research in this field of scientific literature is to evaluate the efficiency or flexibility of process or organization activity, but the coordination of efficiency and flexibility in supply chain especially in practical level is still examined. Thus, in this article we will be examining the following essential question - how the balance of efficiency and flexibility is being obtained in supply chains presenting products of outfit to end customer? Analyzing the question we chose to examine the coordination of efficiency and flexibility in the level of supply chain of textile industry.

- *Scientific problem: the compatibility of efficiency and flexibility in supply chains.*
- *The goal of the research: to ground how efficiency and flexibility are being coordinated in supply chains of apparel industry.*
- *The tasks of the research:*

1. *Determining of the concepts of efficiency and flexibility in the level of supply chain.*
2. *Distinguishing of the methods of coordination of efficiency and flexibility in supply chains.*
3. *Analyzing how efficiency and flexibility are being coordinated in the supply chain of apparel industry.*

- *The object of the research: the supply chain of apparel industry.*
- *The methods of the research: scientific literature analysis, case study.*

This article contributes the researches in the field or chains by describing how efficiency and flexibility are being balanced in practice. The research results are giving a particular starting point in selection of balancing of efficiency and flexibility in supply chains. This article is composed of three sections. In the first section there is presented analysis of scientific researches examining efficiency and flexibility. The second section analyzes methods of coordination of efficiency and flexibility in supply chains. In the third section there is presented case analysis referring to which the conclusions were made challenging the most common methods of coordination of efficiency and flexibility.

THE CONCEPTS OF EFFICIENCY AND FLEXIBILITY IN THE LEVEL OF SUPPLY CHAINS

The supply chain includes all activities in creation of additional value to customer, from suppliers of raw material to end user of the good. Thus, supply chain is cooperation of suppliers and partners and sharing of information by focusing towards satisfaction of customers needs [23, 7]. The article is founding on Christopher's [10] description of supply chain stating that supply chain is the network of organizations connected and interrelated which jointly manages, controls and develops the flows of materials and information from suppliers to customers. The supply chain consists of network of organization connecting different processes and activities that are creating value for end user in form of product or service.

Therefore, from the description of concept of supply chain the conclusion could be made that it is important to look at supply chain as a whole process of product of service presentation to the customer. Process efficiency is described as ratio of the reached result and used resources. Of course, efficiency of separate activity of every process influences shared efficiency of supply chain. Besides, in our opinion it is necessary to highlight that many particular activities of this process have different managers with different abilities and interests. These differences of interests and abilities make the supply chain and its management more complicated than particular process. While talking about organization's efficiency this concept is described as a degree of utility of the use of the resources managed [34]. Meanwhile efficiency of supply chain is described as a degree of employment of short-term and long-term assets in striving to satisfy customers needs [21]. Having evaluated that supply chain is an instrument to supply products and services for customer, we suppose, that this description is exact and clear enough and doesn't require discussions. Thus, while looking at supply chain as a whole process of supply of goods or services for customer, the efficiency of supply chain has to be expressed in degree of efficiency of employment of resources of all partners participating chain activity in striving for shared goal.

There are many kinds of flexibility and indeed a sizable literature devoted to competing typologies of the various kinds of flexibility [35]. Flexibility is the ability to adjust to changes in product mix, production volume, or design [29]. Sanchez & Perez [30] state that supply chain flexibility include following abilities:

- *to produce different and new sophisticated non-standard products corresponding particular needs of consumers;*
- *to produce the orders of different volumes, i.e. manage output;*
- *to use alternative methods by transferring all instruments needed for future work to the due place; to adapt to the changes while transferring;*
- *to supply a final product available to consumer.*

Thus, flexibility can be perceived as adaption to environmental unpredictability and volatility [2]. Description of flexibility given by other authors is more extensive: this is ability to change or react to changes and use little time, costs and efforts for this purpose [38, 40]. For Carlsson [5], there are two types of flexibility that follow from this distinction between risk and uncertainty: type I (static) flexibility is concerned with routines for dealing with foreseeable events and type II flexibility (dynamic) relates to the capacity to react to unpredictable environmental or technological changes. While talking about flexibility in the level of supply chain there are distinguished concepts of inner and external flexibility [39, 12, 30]. Inner flexibility is related to organization's flexibility and external flexibility is related to partners' flexibility. Vickery et al. [39] is relating supply chain flexibility to ability to satisfy consumers' needs and expresses it as possibility to supply different products, production quantities, variety of new products and availability of product to consumer as response to market demand. Lascelles [21] describes supply chain flexibility as mobility responding to market demands and in striving for win or preserve competitiveness. Often supply chain flexibility is described as ability to respond to short-term changes of demand or supply [27]. Therefore, flexibility in the level of supply chain is ability to adapt to changes of inner and external environment. Having summarizer point of view of different authors [11, 18, 6, 3), it could be stated that flexibility is ability to adapt to environmental changes.

Analyzing concept of flexibility in business and management field the concept of adaptation is being distinguished as well. Adaptation is described as ability to adapt to long-term, irreversible changes. Nevertheless, it is possible to make a statement that concepts of flexibility and adaptation from the point of view of ability to adapt to environmental changes are synonyms. Summarizing it

could be stated that organization's flexibility is described as ability to adapt to changes of inner and external environment.

Also the concept of elasticity is being used. Elasticity is system's feature to restore to required original condition after interference [10]. We think, that elasticity is a response to supply changes and it is a component of flexibility. Accordingly, it is possible to determine the main factors what make influence for the company's dependence to find compatibility of efficiency and flexibility. After review of concepts analyzed the conclusion could be made that efficiency is ratio of reached result and used resources, and flexibility is the ability to adapt to changes of inner and external environment. Therefore, efficiency in the context of supply chains is ratio of the result achieved and resources used evaluating the time when raw materials, semi-manufactures and products are moving in all manifold of product supply chain. Flexibility in the context of supply chains is ability to adapt to changes of inner and external environment by using little input in all supply chain.

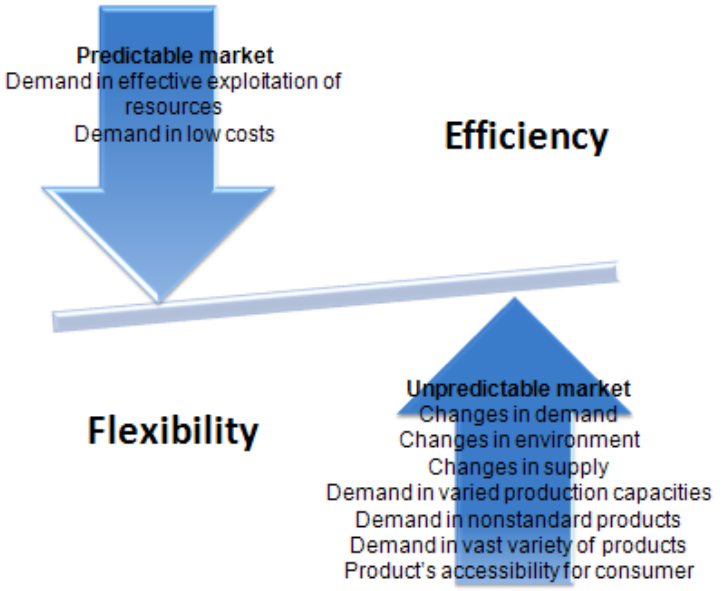

Figure 1 – The main factors what make influence for the company's dependence to find compatibility of efficiency and flexibility

COORDINATION OF EFFICIENCY AND FLEXIBILITY IN SUPPLY CHAINS

Supply chain consists of network of organizations having own place in incoming and out coming connection, that connects different processes and activities creating value to end user in form of product or service. Therefore, success of every organization mostly depends on how connections of all chain will be managed [37]. The goal of supply chain is to manage resource selection and supply, manufacturing process, supply of products to end user in such a way that products will move through network of business activities in shortest period and with least input [24].

Experience of organizations show that in creating of value for consumer usually the choice falls on mass customization what has become a major objective of many companies [15]. Evaluating this choice it is easy to notice that mass customization is a choice to scarify flexibility on behalf of efficiency. But efficient supply chains usually are incompetitive because they are not adapting to structural changes of the market [22]. Efficiency and flexibility have to be balanced in consideration of predictability of demand, and to decide whether priority should be given to flexibility or efficiency. Also in striving for the goal, it is needed to leave some space for increase of another, less important parameter [13]. Also it is important to note, that balancing of efficiency and flexibility is very important and complicated in unclear and unpredictable environment [13]. If market of the product is characterized by stability and demand is easy to predict, increase of efficiency is useful [33]. And contrary, when market of the product is characterized by instability, organizations should choose supply chain that is "risk covering" that is characterized by wide inventory and high flexibility [22, 28]. In the case when changes in the market are not one-off and settled for a longer period, after response to these changes it is worth to concentrate to increase of efficiency [34].

Thus, in striving for increase of business value, it is necessary to balance efficiency and flexibility at the same time or increase one aspect and reserve resources enough for increase of another aspect. Efficiency ensures beneficial use of resources in striving for particular goal, and flexibility creates possibility to react to change of demand and ensure efficiency of use of resources. Besides, flexible output gives possibility to increase incomes while demand increases. But if we'll choose only increase of flexibility, input will by raised by input of wide inventory and transactional costs, and if we'll chose only increase of efficiency, then input will be raised by resources of unsold products.

In striving to balance flexibility and efficiency two approaches are founded: structural ambidexterity and balancing of contrary processes.

***Approach structural ambidexterity** states that efficiency and flexibility are simultaneously contradictory characteristics, therefore, one or another have to be chosen [19]. The most popular method of balancing of efficiency and flexibility is to determine which processes should be converted into flexible, and which into efficient. A sample could be that very often the priorities are chosen to strive for efficiency of manufacturing process and flexibility of designing process. But if organization*

is manufacturing products according to individual needs of consumers, then both manufacturing and designing processes have to be flexible. Therefore, in the level of supply chain the concept of structural ambidexterity can be applied in these methods [34]:

- *by converting part of supply chain processes into efficient and another part into flexible. If considering the needs of consumers the manufacturing of some products efficiency is required and other products require flexibility then two manufacturing processes are available, an one of them will be efficient and another flexible;*
- *by choosing to increase either efficiency when demand is constant, or flexibility when demand is unpredictable. Thus we can save the possibility to use the resources for change of the rest parameter. If only efficiency is being increased then part of resources (inventory, resources and other) remains for increase of flexibility and when it is needed these resources reserved are being used;*
- *increasing flexibility with the help of supply chain. While competing in the global market organizations are choosing development of essential competencies in narrow field, and acquiring competitive advantage with own oneness. Efficiency in the chosen field is being increased by maximally loading equipment available and decreasing variety of tasks as much as possible. Management of supply chain creates virtual organizations that are striving together for supply of products corresponding to consumers' demands to the market. One of the main methods to acquire flexibility is the use of associations, internationalization, product development and competencies assimilation [13];*
- *by increasing efficiency in supply chain and increasing flexibility inside organization by converting processes into flexible.*

***Approach of balancing countervailing processes**. Another point of view to balancing of efficiency and flexibility is trying to balance them by purposeful actions. Eisenhardt et al. [13] systematized and distinguished three methods of balancing of efficiency and flexibility that were based on purposeful actions of managers at the same time:*

- *method of „simple rules". It is based on essential rules that show the decision of particular problems. By using these rules and taking another decisions, participants of the process have a possibility to improvise the compatibility of efficiency and flexibility;*
- *method of cycles' simplification. Time after time organizations have to eliminate purposefully old rules that are less significant and blocking new changes after situation is changed;*
- *method of flexibility giving structures. Method of flexibility increase is performed by implementing temporary tasks and using implementation of onetime changes.*

Therefore, approach of balancing countervailing processes in the level of supply chain can be implemented by these three methods [34]:

- *with the help of different rules and procedures efficiency is increased and flexibility is increased by implementing new changes in process activity and eliminating old rules;*
- *periodical implementation of changes in efficient processes in order to increase abilities of flexibility;*
- *coordinating of efficiency and flexibility remains heuristic improvisation based on method of „simple rules". Activity performance is base only on essential rules and all other decision making is entrusted to process participants.*

Thus, with the help of efficiency organizations can increase additional value to consumer by decreasing product price. With the help of flexibility resources can be used efficiently, i.e. product can be created that is corresponding to present formed needs of consumer and that will be sold. Supply chains have perfect possibilities for increase of flexibility and efficiency because of possibility to change configuration and partners without big input. Meanwhile organizations are more tended to increase efficiency, but not flexibility, because this is determined by organization's evolution and striving to avoid business risk, and additional costs. Supply chain is perfect instrument to convert not flexible and, in this case, expensive processes into cheap by focusing towards essential organizational competencies, and achieving flexibility by making up activities of supply chain partners into value chain.

It is need to be acknowledged that organizations have perfect possibilities inside to strive for efficient management of resources, meanwhile supply chains are facing challenges in striving for efficiency, except the cases when there is a search for partners supplying cheaper products or services than inside organization itself. In many cases of modern practice supply chain increases efficiency by choosing partners supplying cheaper products or services in global market. Recently this is the simplest implement to increase an efficiency of supply chain because of big differences in prices on global markets. However, rapidly increasing prices in the markets with cheap resources will determine the importance of efficiency in all supply chain including activities of all partners.

METHODS OF RESEARCH

Case analysis was performed by interviewing managers of agile supply chain. Interview had the questions formulated in order to identify possibility of demand predictability, seasonality, capability fluctuations, peculiarities of enterprise activity centralization, criteria and indicators of flexibility and efficiency with regard to the chapter one and two of this study. This research revealed peculiarities of flexibility and efficiency in the supply chain of apparel industry.

For the research the enterprise was chosen that is acting in business sector characterized by mobility, indefinite demand, seasonality, wide range of products, and presentation of new products. So this is obvious that aspect of flexibility is important for this enterprise. This recent focus on flexibility as competitive strategy can be observed in major manufacturing industries, such as above mentioned automobile industry, textile/apparel industry and semiconductor/electronics industry [20, 8]. Thus, the enterprise chosen for the research was apparel industry enterprise Grosso Moda in Holland, which is acting in global market for more than 20 years. Subdivisions of this enterprise are located in Lithuania, Germany, Belarus, Ukraine, Vietnam, China as well.

CASE STUDY

Case research was performed by analyzing chosen apparel industry enterprise Grosso Moda. The enterprise organizes supply chain of apparel industry mass production presentation to clients in global market starting with product designing, search of raw materials and supply, initial samples and collections production, mass production, transportation of ready products to the stores of big clients. Subdivisions of this enterprise are located in Lithuania, Germany, Belarus, Ukraine, Vietnam, China. Network of partners and clients includes the countries of Europe, North America, Asia and Africa.

The activity is performed in business sector characterized by mobility, indefinite demand, seasonality, wide range of products, and presentation of new products. The enterprise designs few thousands products of different models per year. The biggest part of manufacturing and sometimes part of designing in the enterprise is performed by using outsourcing. Transportation services are not performed by the enterprise itself as well but services of partners are used. Manufacturing of some new products requires specific innovative equipment that is available neither by the enterprise nor by outsourcing partners almost in all cases. Thus, it is obvious that flexibility aspect is very important to this enterprise.

Management of the enterprise is dispersed in different geographical regions: marketing is performed in Holland; part of designing works is performed in Holland as well; construction is performed in Lithuania, Ukraine, Belarus, China; purchasing in Lithuania, Ukraine, China; manufacturing in Lithuania, Ukraine, Belarus, Vietnam, China. For coordination of this sophisticated supply chain the information systems, accounting management systems, audio-video systems for broadcasting of international conferences, meetings and other communication means are used.

The long-term goal of the enterprise is to satisfy changing customer demands with regard to assortment, output, and prices. The most significant challenges the enterprise is facing are following:

1) *output seasonality that fluctuates even 100% - 400%;*
2) *big change of assortment, that requires new manufacturing equipment from time to time;*
3) *need for low prices in realization market.*

These challenges determined the necessity for developing of flexible activity and increase of efficiency inside the organization and supply chain as well:

- *For insurance of required output that changes in dependence on particular demand and manufacturing products of different range the enterprise uses manufacturing outsourcing. It is risky to extend vertical integration by purchasing of new output because of fluctuating need of output. Also it should be evaluated that vertical integration has potential possibilities to increase benefit by decreasing input, and virtual integration creates possibility to increase benefit by increasing output and decreasing costs [4, 17, 1, 31];*
- *The enterprise has developed designing, purchasing and manufacturing activities as flexible inside the enterprise. Flexibility of these activities is formulated in striving to satisfy customers' needs in regard to different assortment, different output, and manufacturing of new products. Despite the enterprise using balancing countervailing processes approach suffered losses, but it developed the activities as flexible further. Such decision was determined by point of view that essential abilities are giving the organization oneness in competitive environment [25, 26] and favorable environment for processes development [36]. It is also noticed that the enterprise manufactures some models that are repeating from time to time and demand for these models is predictable, but in striving for development of own manufacturing process as flexible, manufacturing of these models is transferred to partners;*
- *increase of efficiency is very important to the enterprise in order to compete by low prices in world market. Therefore in order to compete by low prices in world market, the enterprise transferred manufacturing and in some cases constructions to other countries characterized by cheaper labor force and uses manufacturing outsourcing in cheaper regions. Having expanded*

geographically the supply chain in such a way, the same product having lower input could be presented with lower price to customer;

- *The enterprise in its flexible activities of designing, manufacturing and purchase is striving for increase of efficiency as well by eliminating the activities and time that are not creating any value. Further we'll illustrate specific method of efficiency increase by using innovative communications which was successfully used in striving for decrease of efficiency and costs of constructors work. In order the customer would confirm the order for outfit for manufacturing, a try-on of initial samples is necessary according to the measurements of forms of common population. Thus the enterprise suffered a lot of time and costs that are not creating value because of big amount of employees' business trips related initial outfit try-on. The process of outfit try- on was changed avoiding many of such business trips. Thus, the enterprise obtained innovative audio-video equipment with help of which outfit try-on can be performed in Holland and watched in Lithuania, Ukraine or another country simultaneously and continue construction with regard to client notes. This gives a possibility to avoid time that does not creates value and presenting of the product to the market much quicker. As was mentioned, with help of this method it was striving for increase of efficiency but the experience shows that this development of information management highly increased flexibility as well because many activities related to construction, management of supply chain and solving of different problems are performed by using this equipment. Efficient balancing between different parts of supply chain plays critical role in striving for use of innovations, flexibility and speed [22]. By increasing efficiency is such a way flexibility increases at the same time as well. It is difficult to say if the enterprise won more efficiency or flexibility;*
- *For manufacturing of new products the enterprise does not strives for investment into increase of own output but into purchase of innovative equipment and their rent to business partners performing manufacturing function. Thus the enterprise increases flexibility in manufacturing of new innovative products.*

This case research showed that big supplier of apparel production Grosso Moda which geographically decentralized its structure and developed its activity as flexible, for some time past prefers efficiency in the activities that require flexibility.

CONCLUSIONS

Efficiency in the context of supply chains is ratio of the result achieved and resources used evaluating the time when raw materials, semi-manufactures and products are moving in all manifold of product supply chain. Flexibility in the context of supply chains is ability to adapt to changes of inner and external environment by using little input in all supply chain.

Case analysis shoved that many activities of the apparel industry enterprise Grosso Moda are developed as flexible because of indefinite demand, output demand seasonality, assortment change, new products manufacturing. Thus, the organization competing in global market chose essential development by making activities flexible, and obtained competitive advantage with own oneness. Both the efficiency and flexibility are increased in supply chain and inside the organization.

Summarizing it could be said that both structural ambidexterity approach and balancing countervailing processes approach were adapted. Application of balancing countervailing processes approach demanded more losses but after development of competencies no more losses appear. But the enterprise have reached critical line of manageable flexibility and recently started looking for compromise between flexibility and efficiency on behalf of the latter.

Rapidly increasing prices in the markets of cheap resources (for example China) determined that efficiency cannot be reached by using these cheap resources, therefore possibilities of supply chain in regard to efficiency decreased. Because of that reason the enterprise increases efficiency more and more in flexible activities, i.e. decreases cost by maintaining flexibility.

Summarizing it could be stated that the enterprise examined is balancing the striving for efficiency and flexibility in supply chain considering available competence of activity management and possible risk.

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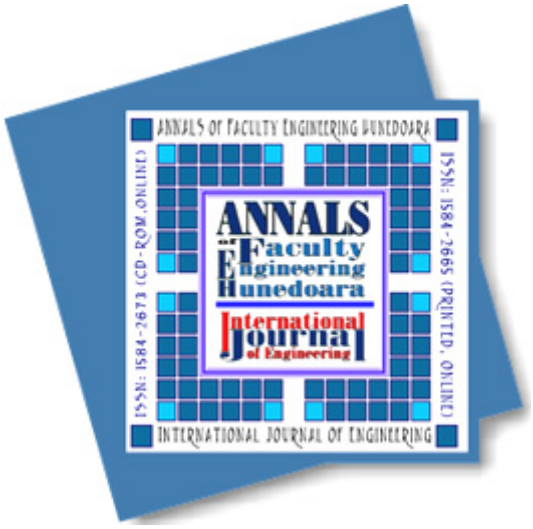

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