

Supply Chain Management Efficiency Research Based on Example of JSC “Communication Systems”

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Abstract

Economic crisis, need to save, shortage of circulating assets, decline in demand, cash flow imbalance and the aggravated opportunities to borrow force companies to better manage the supply chain. The article presents the definitions of the supply chain and supply chain management, identifies the supply chain management efficiency measurements and describes the associated supply chain management study carried out in JSC “Communication Systems”. Supply chain management optimization variations are provided with reference to optimal inventory management in a company and the classical model of economic assessment of optimal number of production units.

Keywords: supply chain, supply chain management, supply chain processes, supply chain management efficiency.

Introduction

Industrial and technological revolution of the last century radically transformed the approach to key economics levers: manufacturing, service and consumption. Regionalization, globalization, mergers and reorganization particularly exacerbated competitive disparities and one after another mercilessly displace the weakest players from the market. Persistent economic fluctuations – from rise to recession – force to understand the importance of working capital, demand volatility and the impact of global saving program. Tightened credit facilities inevitably encourage more efficient management of business supply processes, as well as connection to one chain mechanism.

Both the managers and the employees raise the need for continuous and accurate business information management, which enables optimization of cash flow and costs, and helps to ensure the efficiency of management. For this reason there is no surprise that effective and successful decision-making depends on the basic economic asset – information – that makes it possible to combine all the manufacturing processes in a supply chain cycle.

Supply chain management remains a topical subject of debate. Researchers such as Forrester

(1958), Rayport, Sviokla (1994), Cooper, Lambert, Pagh (1997), Aitken (1998), Chen, Drezner, Ryan (2000), Christopher, Towill (2001), Holweg (2006), Lee, Padmanabhan, Whang (2007), Lambert (2008) analyzed supply chain management processes not only in procedural aspect through managerial governance, but also looked from economical point of view, assessing the created added value (with help of financial indicators), consequences of whip (uncertainty) effect and the reliability of forecasting of demand for products of the company. Economic theory does not give answer to the question how to make the supply chain management process efficient, but helps to identify areas where defects are visible. In turn, fields of management due to inadequate economic assessment may not produce the desired results, can suffer temporary disruption or even great losses. In Lithuania, such economics and management sciences modeling philosophy in the processes of supply management is relatively new direction and little experience in it becomes an urgent problem for business activity. Lack of research makes the problem novel and opens up ample opportunities for scientific analysis.

The subject of the article: the supply chain management of JSC “Communication Systems”.

The aim of the article: to carry out the analysis of performance of JSC “Communication Systems” supply chain management.

To achieve the aim, the following objectives have been set:

1. To define the theoretical concepts of supply chain management and the measures of efficiency of supply chain management.
2. To analyze the triad data of efficiency of management of supply chain of JSC “Communication Systems”.
3. To identify the current situation of management of supply chain of JSC “Communication Systems” and to offer opportunities to improve the performance of the system.

Research methods: quantitative and qualitative analysis of the results, data grouping, comparative analysis, forecasting methods, induction and deduction methods.

The scientific assessment of the concept of supply chain and supply chain management

In order to disambiguate the concept of supply chain management it is inevitably necessary to clarify the concept of supply chain first. Initially the concept of supply chain was used as a definition of loss of raw-materials inside and outside the company, but later this initial approach has expanded.

Analysing the opinion of several authors (Houlihan, 1987; Davenport., James, 1990; Cooper, Ellram, 1993; Cooper, Lambert, Pagh, 1997; Aitken, 1998; Kavaliauskiene, Survilaite-Bagdonaviciute, 2004; Holweg and Pil, 2006; Christopher, 2007 and others), it can be seen that the supply chain is often equated with the logistics, but these two definitions are different.

Definition of logistics includes planning, realization, performance monitoring, flow control, warehousing and maintenance from an external source to

organization and from the organization to the point of consumption, adapting to the needs of a consumer (Christopher, 2007).

According to Vorst Van Der (2000), the supply chain is a network of companies connected by direct and indirect relationship between different processes, products and services, in the form of creating value to the end user. According to Miller, Roth (1994), Cooper, Lambert, Pagh (1997), Lambert, Dastugue, Croxton (2005), the supply chain represents a new way of business management and relationships with other members of supply chain.

In general approach, supply chain is understood as a system consisting of suppliers, manufacturers, traders, service representatives and customers, where goods, raw materials and components are moving downwards, cash flow, in contrast, – upwards, and information – in both directions of the chain (Rayport, Sviokla, 1994). Processes and cycles of supply chain are presented in Figure 1.

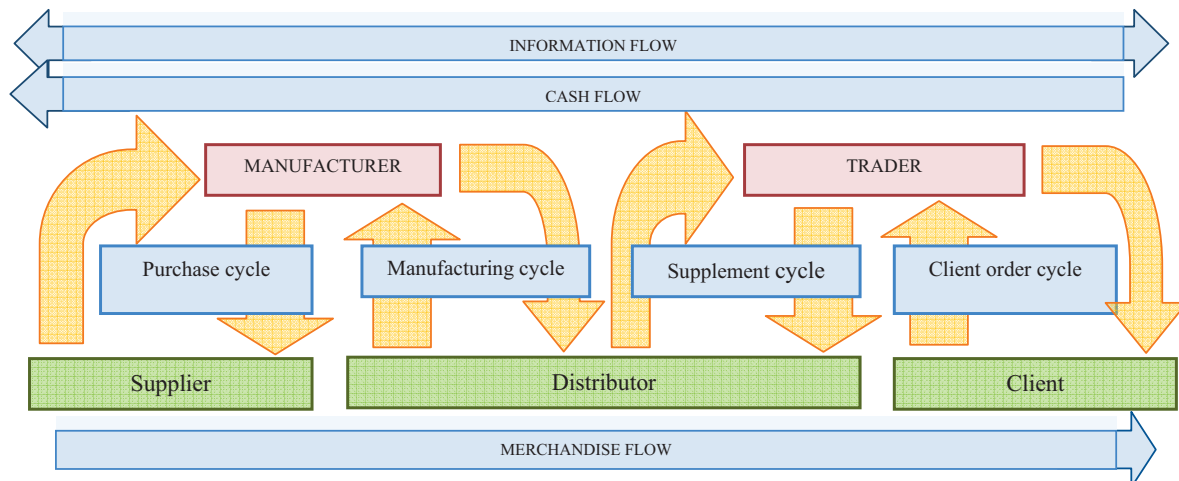


Figure 1. Participants and process cycles of supply chain

Source: drawn by the authors, with reference to Rayport, Sviokla, (1994), *Managing in the Market space*; Lee, So, Tang (2000), *The value of information sharing in a two-level supply chain*; Chopra, Meindl, (2003), *Supply Chain Management: Strategy, Planning and Operation*.

Traditional supply chain is made by modeling five or more participants, where each of them carries out its functions. The main players in the supply chain processes are considered to be:

- raw-materials suppliers – companies producing and supplying raw materials necessary for manufacturing process;
- producers – the supply chain participants producing and providing the products and services for final use;
- wholesalers – the institutions and organizations buying large quantities of products from manufacturers with the aim of supplying them to retail markets;
- retailers – participants selling the final products to a consumer in small quantities;
- consumers – individuals or groups of individuals, companies and organizations purchasing the products for final consumption.

Supply chain activities include planning, control, coordination and integration of information systems elements that are generally understood as management process. According to Aitken (1998), in order to effectively manage the operation of supply chain, it is necessary to view the supply chain as a single unit, rather than collection of separate companies. Christopher and Towill (2001) suggest that one of the most important aspects of supply chain management is systems theory that connects all aspects to each other and plays a role. It is important that the elements would be related to and would work for each other.

Such an analysis highlights the principle of two

criteria important for concept of supply chain management. First – installing business processes orientation in business activities, inside the functional structure and between organizations. Second – this is more than logistics – the management of all business processes.

According to Kavaliauskiene and Survilaite-Bagdonaviciute (2004), supply chain management is not only a logistics process, but all business processes in principle. Seen this way, the supply chain business processes are management inside the organizations and between the organizations.

Supply chain management can be seen from different perspectives: economical (formation of networks), strategic business, technological, cultural and financial. Johanson and Pyke (2000) propose to analyze the supply chain management by splitting it into even smaller management units, such as transportation and logistics, forecasting, information technology, globalization, and others. However, such an assessment does not disclose the concept of supply chain management, only allows the assessment of components of the industry of supply chain management.

Christopher (2007) argues that supply chain management should be understood as business pro-

cess integration within the supply chain. According to the author, supply chain logistics is not the same as supply chain management. Supply chain management contains the coordination and integration of business processes from the end user to original products, services and information suppliers, which provide value to customers (Holweg and Pil, 2006).

According to Harland (1996), supply chain management is understood as the process of coordinating all businesses organizations connected to a network and participating in delivery of final product and service to the end user. This set of actions is related to materials, parts and finished products in the process of planning, coordination and management between suppliers and consumers. Supply chain management encompasses all movement and storage of raw materials, labor and inventory processes and delivery of goods from production sites to consumption areas.

According to Wailgum and Worthen (2008), supply chain management is a combination of art and science, which aims to improve distribution efficiency of their raw ingredients needed to create the desired product and deliver it to consumers. Table 1 lists five main components of supply chain management.

Table 1

Components of supply chain management

<p>1. PLANNING. This is a strategic supply chain management area providing management tactics that help organizations to control resources necessary to meet the demand for products or services. Constant supply chain control and its effective assessment must ensure lower costs, higher quality and higher value to customers.</p>
<p>2. SUPPLIER MANAGEMENT. Organization must ensure the correct selection of suppliers of goods and services, an appropriate price, delivery and payment process systems to promote good relations with suppliers. Such a system makes combining of product and service management processes into a single system successful.</p>
<p>3. PRODUCTION. Supply chain managers need to plan production activities, production testing, packaging and delivery. This is the most intensive part of the supply chain, in which companies can assess the level of quality of goods and labor productivity.</p>
<p>4. DELIVERY. This level of supply chain management is characterized by the concept of logistics. Distribution network, storage schedules, selected carriers and invoicing systems should be created by considering customer's orders.</p>
<p>5. FEEDBACK. The formation of feedback system can be complicated for many companies involved in the supply chain. Supply chain makers must assess the network flexibility in order to recover the low quality and surplus production from their customers and have an opportunity to assist clients with product delivery problems.</p>

Source: made by the authors with reference to Barratt (2004), Unveiling Enablers and Inhibitors of Collaborative Planning; Wailgum, Worthen (2008), Supply Chain Management Definition and Solutions.

According to Cooper, Lambert, Pagh (1997) findings in the supply chain management process fall into three basic and closely related areas (Figure 2):

- business process management as an activity that produces a useful product to the specific customer;

- coordination of control elements by which business processes are structured and managed;
- supply chain structure represented as an organizational supply chain management.

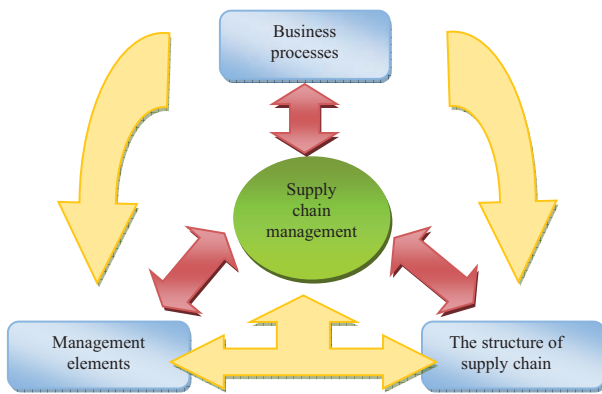


Figure 2. Supply chain management areas

Source: made by the authors with reference to Cooper., Lambert, Pagh (1997) Supply Chain Management: More Than a New Name for Logistics.

According to Figure 2, it is clear that the supply chain management processes can be identified by their positive and/or negative changes caused to sites exposed to them. Depending on the supply chain structure, the supply chain business process can cross the internal and external organizational boundaries.

Closely interwoven with the logistics management processes, the supply chain management system still has sufficiently unique characteristics and can be interpreted as the information system supporting the supply chain process and providing the tools for analysis and optimization. Supply chain management enables the network to coordinate all connected business organizations participating in delivery of the final product and service to the end user. In this respect, supply chain management action moves closer to the business and the wider opportunities for more efficient consumer needs.

The assessment of efficiency of supply chain management

The efficiency of supply chain management can be twofold: the operational efficiency (which shows how effectively separate supply chain units are managed in order to meet user demands) and the efficiency of creating value (when the correct solutions of supply chain management create surplus value to the company in a way of positive cash flow) (Lascelle, Dale, 1989).

The operational efficiency of supply chain can be achieved by moving from individual company's assessment to integrated company's assessment (including assessment of its relationships with other companies or organizations) and vice versa. Improper coordination of the supply chain reduces the positive cash flow, increases operating costs and significantly lowers value of the company. In this respect, the mechanism of supply chain management must ensure

the most effective supply chain activities, which is reflected by declining operating costs, increasing transparency and appropriate response to market changes. This helps to regulate the level of raw materials in the organization, reduces the requirements of the working capital, increases profitability and leads to a higher level of customer service, thereby maintaining a competitive advantage.

The main features of efficiency of supply chain management are the presence of the right products on the right time for the right price with required quality in the right place. And these conditions must be fulfilled faster than competitors will do the same.

The assessment of efficiency of supply chain management is quite new academic direction in Lithuania and therefore has no clear scientific evaluation system. One of the biggest obstacles to achieving efficiency in the supply chain is inefficient allocation of financial resources and limited abilities of demand forecasting. Inefficient allocation of financial resources means that the organization is increasing production costs and decreasing profit margin. Moreover, the closer is supply chain to the end user, the better it can predict demand. The farther is the distance, the more complex becomes the forecast and the greater becomes the impact of bullwhip (uncertainty) effect.

According to literature from various sources of analysis, authors distinguish supply chain management efficiency triad: financial analysis, demand forecasting and bullwhip effect (see Figure 3).

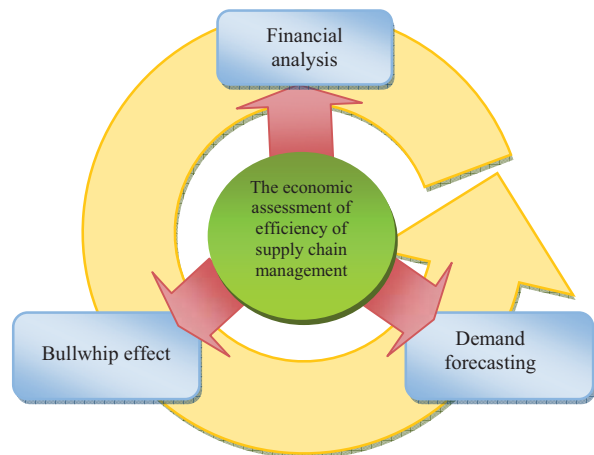


Figure 3. Supply chain management efficiency triad

The evaluation of financial performance helps to identify the financial situation, effective and ineffective areas of usage of financial resources of companies operating in supply chain. Knowing the financial situation of a company, it is advisable to evaluate the accuracy of demand forecasting and its impact on the overall profitability. Accurate prediction of conditions helps to save raw-materials and resources, reduce manufacturing costs and overall production costs.

In contrast, too optimistic forecasts can cause serious problems of liquidity of elements. Limited demand forecasting abilities have uncertainty effect called bullwhip effect. This is one of the main problems of supply chain management. This effect can occur in each phase of the supply chain by increasing the fluctuations of demand. The farther away one moves from the final user to the raw-material supplier, the bigger ineffectiveness resonance of uncertainty one achieves.

The assessment of efficiency of management of supply chain of JSC “Communication Systems”

In view of the Lithuanian business situation, for this analysis was selected a company of one of the most common types of business enterprises in Lithuania: joint-stock company. The main subject of the study became a company offering television production systems, design and installation services. According to Hammer, Glenn (1987), it is a quite complex and knowledge-intensive industry, the specificity of which requires a high level of expertise, extensive management of information flows and dynamic approach to the firm’s close links of communication. In view of the shareholders’ and managers’ desire for confidentiality, the real name of the company was changed to JSC “Communication Systems”.

According to the model presented in Figure 3, the analysis begins with evaluation of financial per-

formance of JSC “Communication Systems” in the period of 2005–2008. The obtained results show the success of the company in year 2006. Pursuant to the achievements and the increased number of sales in year 2006, the company planned the results of the next term, but the selected strategy proved to have been too optimistic and did not realize company’s objectives. During the period of analysis, general and administrative expenses grew faster (78.58%) than sales (73.04%). The changing rates of profitability showed that during the period of analysis sufficient attention was not paid to management of supply costs. Current assets during year 2007 (in comparison with year 2006) increased by 44.05%, while the debts of the customers accumulated rapidly and the growth rate reached 454.41%. This change by 133.09% increased the absolute value of the company’s accounts receivables, and showed that in 2007 the company’s supply management process was managed inefficiently. An analogous situation occurred in 2008. Raw-material rate grew by 146.53% and reached 11.6 million LTL, a large portion of the company’s short term assets were frozen in a form of raw-materials, and the share of sold production did not ensure adequate cash flow. Return on assets showed a similar trend as the property’s profitability. The highest returns were achieved in year 2006, then the value of indicator has exceeded 48%, but it has dropped in the next period to 31.73% and in 2008 it reached the rate of 27.61% (see Table 2).

Table 2

The assets and profitability indexes of JSC “Communication Systems”, %

Variable	2005	2006	2007	2008	Change
Supply activities profitability	15.03	20.10	15.52	23.71	8.68
Activities profitability	4.89	15.98	8.70	13.25	8.36
Supply activities in return on assets	14.30	48.01	31.73	27.61	13.31
Asset yield	4.68	30.79	15.60	8.71	4.02

Company’s poor sales, planned too large raw-material quantities, increased customer debts and low turnover of assets prevented from achievement of the planned results in 2007 and 2008 and significantly reduced the company’s profit target. In this respect, the selected delivery strategy became ineffective, and therefore part of the financial resources remained frozen in the form of raw-material or customer debts.

On the basis of assessment of efficiency of model of entity’s supply chain management, a sales forecast of the company was made by normal distri-

bution, II and III parabola trend function, the dynamic alignment of the line with the average absolute growth rate and exponential smoothing methods. The combination of all predictors of outcome into a single system made estimates of the targets more accurate. Such an assessment is carried out by using a simple or a weighted forecast average.

According to the calculations made (see Table 3), it is probable that in year 2009 the sales will reach the amount of 33.25 million LTL, and in year 2010 should get to 38.12 million LTL.

Table 3

**Sales and weighted forecast average method of JSC “Communication Systems”
in years 2005–2010**

Variable	2005	2006	2007	2008	2009	2010
Factual meaning, LTL	17,797,683.00	40,259,375.00	44,222,443.00	30,796,428.00		
Weighted average meaning, LTL	18,825,384.33	28,898,597.27	37,302,433.54	32,805,942.42	33,253,849.42	38,115,615.81
Deviation of factual meaning, LTL	-1,027,701.33	11,360,777.73	6,920,009.46	-2,009,514.42		
Deviation of factual meaning, %	5.77	-28.22	-15.65	6.53		

The expected average deviation from the sales should not exceed 14.04%. In order to more accurately assess changes to the potential sales volume it is appropriate to improve the formula for calculation of simple average. Extension of the calculations for two variables will enable more effective assessment of the sales forecasts for the forthcoming two-year period:

$$\bar{y} = \frac{\sum y_t}{n} \times b^{\frac{1}{w}}$$

where: y_t – forecast in t period;

y – average values;

n – number of observations;

b – the expected change in the industry, %;

w – the probability of expected change in the industry.

For this purpose, a simple average formula is added to analyze the expectancy of changes in the

company’s industry and the forecast probability of the occurrence factor. According to the data of Lithuanian Department of Statistics under Government of Republic of Lithuania, in the first quarter of 2009 retail trade in audio-visual equipment and services decreased by 36.8% (Department of Statistics under Government of Republic of Lithuania, 2009). According to company forecasts, most of activities of the company are connected with audio and video equipment manufacturing and marketing, so the expectation ratio applied to the new formula can be 90%.

In this respect, recalculated prognostic indicators of sales are grouped in Table 4. According to the assessment of economic developments and their probabilities, it is concluded that in year 2009 the company’s sales would decline to 18.7 million LTL, and in 2010 to 21.5 million LTL.

Table 4

**Recalculated sales and forecasts of JSC “Communication Systems” according
to the method of weighted forecast average in the year of 2005–2010**

Variable	2005	2006	2007	2008	2009	2010
Factual meaning, LTL	17,797,683.00	40,259,375.00	44,222,443.00	30,796,428.00	33,253,849.42	38,115,615.81
Weighted average meaning, LTL	18,825,384.33	28,898,597.27	37,302,433.54	32,805,942.42		
The meaning recalculated according to the quarter I data of DS ($w = 0.9$), LTL					18,738,648.88	21,478,269.56

The assessment of deferred sales volume allows calculating the need for the raw-materials necessary to meet the forecasted demand. Knowing the volume of reserves of raw-materials, the company managers can allocate financial resources more efficiently and effectively organize the mechanism of management of the supply chain. This approach makes it

possible to avoid the risks associated with freezing of surplus resources in a form of raw-materials and other potentially cost-ineffective business processes. Although none of the forecasting methods can guarantee the absolute accuracy of forecast, but the use of systematic assessment methodology can prognosticate the sufficiently accurate situation of the business

and help to avoid inefficient use of assets of the organization.

To ensure efficiency in supply chain, it is not enough to know the results of company's business performance. As the number of supply chain participants increases, at the same time the uncertainty grows, which can cause serious damages to all organizations involved in the chain. In this respect, the investigation continues with the objective to assess the potential impact of the uncertainty effect on processes of management of supply chain of JSC "Communication Systems".

The uncertainty effect reveals the phenomenon of the end-user demand variability, which causes supply chain problems, such as those of raw-material level, low productivity, transportation issues and outstanding orders. Company uses the buyer's order information as a signal of the future demand. According to this information, the company adjusts its demand forecasts and directs orders to the seller. The processing of the demand signal has a significant impact on the uncertainty effect.

JSC "Communication Systems" is a retail company that monitors the demand and places orders to its wholesale suppliers. While the volatility of production orders received by JSC "Communication Systems" is significantly lower than the volatility created in its orders, the wholesaler is obliged to secure more raw-materials and to maintain higher capacity than the JSC "Communication Systems". For this reason it is important to identify the technological processes and tools to monitor the effect of uncertainty, i.e. to control the volatility of growth in the supply chain.

To control the occurrence of the uncertainty effect it is important to quantitatively evaluate the process. Such an evaluation of the bullwhip (uncertainty) effect is understood as an evaluation of increasing volatility that affects all stages of supply chain. Such an analysis will help to reveal the relationship between forecasting techniques, the order execution period and the volatility increases of JSC "Communication Systems".

The model supposes that JSC "Communication Systems" always faces the same order fulfillment time, therefore the given order at the end of the period t is obtained to $t + L$ at the beginning of the period. JSC "Communication Systems" also applies a simple peri-

odic inventory review policy when the all raw-materials are reviewed each period and delivered in order to maintain the target raw-material size.

Such a reserve policy of JSC "Communication Systems" must assess the users' demand and the average standard deviation. Therefore, in practice, the order point may change from day to day, depending on the change the average demand and the standard deviation are assessed. Daganzo (2004) offers specific method of calculation of order placing t in a period y_t , based on a one-day demand evaluation

$$y_t = \hat{\mu}_t L + z\sqrt{L}S_t, \text{ where:}$$

$\hat{\mu}_t$ and S_t are pro rata one-day consumer demand meaning and the standard deviation of the period t , respectively.

L is raw-materials supply period in days.

Z is a constant called the safety factor. Safety factor Z is selected from the statistical tables and helps to ensure that the probability of lack of merchandise during order delivery will be exactly $1-a$.

The model supposes that average of the demand of JSC "Communication Systems" in each period is assessed on the basis of the average demand of past periods of time p . The standard deviation of demand is assessed by the same method, so if D_i represents the users' demand in a period i , then:

$$\hat{\mu}_t = \frac{\sum_{i=t-p}^{t-1} D_i}{p} \quad \text{and} \quad S_t^2 = \frac{\sum_{i=t-p}^{t-1} (D_i - \hat{\mu}_t)^2}{p-1}$$

The formulas above show that JSC "Communication Systems" calculates the new average demand and standard deviation in each period, by referring to observations of past years p . As the average demand and standard deviation values change each period, the target level of raw-materials in the company changes each period as well. In this case it is possible to identify and quantify the volatility increase ("bullwhip" effect) in volume, i.e. to calculate the volatility faced by the JSC "Communication Systems". Required calculations are presented in Table 5.

Table 5

Sales of JSC "Communication Systems" in a period of 2005–2008, in units

Year	2005	2006	2007	2008
The number of sold television systems, in units	18	23	28	19
The average number of sold television systems ($\hat{\mu}_t$), in units	22			
The standard deviation of sold television systems (S_t), in units	4			

Source: made by the authors with reference to data provided by JSC "Communication Systems".

JSC “Communication Systems” reserves TV complexes to have enough of them for 4 weeks, more precisely, for 28 days. It must be supposed that the probability of lack of raw-materials is 5 percent, then:

$$28 \times 22/365 + 1,65 \times 4/365 \times \sqrt{28} \approx 1.76 \text{ units}$$

According to calculations made above the point of order of JSC “Communication Systems” is 1.76 units, i.e., to meet the emerging demand the company must always have nearly two TV complexes.

If the demand change of the buyers of JSC “Communication Systems” is $Var(D)$, then change of orders supplied to the manufacturer by JSC “Communication Systems” is $Var(Q)$ and satisfies the 5 inequality:

$$\frac{Var(Q)}{Var(D)} \geq 1 + \frac{2L}{p} + \frac{2L^2}{p^2}$$

Usage the data of JSC “Communication Systems” (average raw-materials provision period L (28 days) and the annual data $p = 365$), the following inequality is obtained:

$$Var(Q)/Var(D) \geq 1.17$$

JSC “Communication Systems” on the basis of a one-year observation evaluates the average demand. At the end of the period t given order is obtained to the $t + 28$. In this case the demand variability of JSC “Communication Systems” manufacturer is at least 17 percent higher than the variability that came from consumer companies.

Figure 4 shows the limit of volatility growth in JSC “Communication Systems” supply chain, depending on demand observation averages p and the values of time of completion of orders L . As L is higher and p is lower, the “bullwhip” effect increases. The current uncertainty effect of the company is $L = 28$ (see Figure 4).

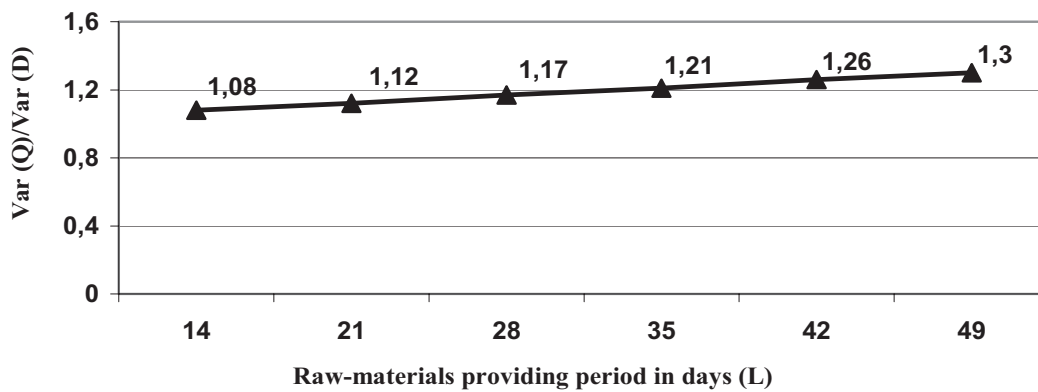


Figure 4. The uncertainty effect of JSC “Communication Systems”

If JSC “Communication Systems” for calculation of the average and standard deviation used only 100 demand observation periods p instead of 365, the volatility of orders given to manufacturer would increase up to 72 percent. Furthermore, if the company’s raw-materials would be supplied not in 28 days, but, for example, in 49 days, the uncertainty effect would reach 30 percent. In other words, a permanent review of raw-materials ordering periods and the increase in number of observations used in calculation of moving average can significantly reduce the volatility of orders in the supply chain.

The identification and assessment of the uncertainty effect allows the company to put forward proposals for reduction or elimination of effect’s impact, like reduction of uncertainty, reduction of volatility of consumer demand, shortening of order fulfillment time, and strategic partnership development.

1. *Reduction of uncertainty.* To reduce the uncertainty effect of the JSC “Communication Systems”

the centralization of demand information in the supply chain is necessary, so that every company in the supply chain could be aware of real consumer demand. When demand information is centralized, the company will be able to use actual consumer demand data and to create more accurate demand forecasts than those obtained on the basis of demand data of previous periods.

2. *Reduction of volatility of consumer demand.* The effect of uncertainty can be reduced by reducing the volatility of consumer demand. If JSC “Communication Systems” relaxes consumer demand volatility, even in case of the occurrence of the uncertainty effect the wholesaler as well as the company will be less impacted. Consumer demand variability can be reduced by using the “every day low price” (called EDLP) strategy. If JSC “Communication Systems” used the EDLP strategy, it could always offer a product for the same stable slightly lower price without using special

discounts or regular sales. Removal of price discounts eliminates dramatic changes in consumer demand that occur in conjunction with these discounts. In addition, the EDLP strategy provides a much more stable and less variable user demand basis.

3. *Shortening of order fulfillment time.* Long order fulfillment time leads to increased volatility in each stage of the supply chain, therefore the reduction of order fulfillment time can significantly decrease the occurrence of the uncertainty effect. Order fulfillment time consists of two components: the goods wait time (time during which the production and transportation of goods is completed) and information wait time (occurs in the order fulfillment and administration time). This distinction is important because goods wait time can be shortened by the choice of acceleration of the delivery process, and the information wait time can be reduced by developing electronic data transmission systems.
4. *Development of strategic partnership.* The uncertainty effect can be eliminated by developing strategic partnerships. Strategic partnership replaces the information-sharing and raw-materials management techniques in the supply chain and significantly diminishes the uncertainty effect. The manufacturer, who holds his raw-materials taking into consideration the customers' orders and determines himself the quantity of reserves to keep and the quantity to sell to retailers on a daily basis, can easily reduce the occurrence of "bullwhip" effect.

In conclusion, if the company wants to be able to cope with volatile demand, it is forced to keep extra stock that is related to higher costs in the entire supply chain. After the analysis of uncertainty affect of JSC "Communication Systems" it is clear that the company's orders to manufacturers exceed the consumers' orders to the company by not less than 17 percent.

Conclusions

1. Supply chain management encompasses the organizational business processes and goes beyond by including all corporate networks to create a finished product or service. With the help of supply chain management process, information about all participants of the supply chain is collected, processed and coordinated. In order to evaluate the effectiveness of supply chain management in the organization, the supply chain management efficiency model, which is based on financial analysis, de-

mand forecasting and uncertainty ("bullwhip") effect evaluation, has been created.

2. Summarizing all the financial indicators of JSC "Communication Systems" that are used for the evaluation of efficiency of supply chain management, it was found that in 2006 the company was extraordinarily successful. Pursuant to the achievements in 2006 and the increased number of sales, the company has over planned the results of the next period and the selected strategy proved to be too optimistic and not in line with the company's objectives. Poor growth of sales, over planned raw-material levels, increased customers' debts and the low asset turnover rate indicated that the company failed to implement the planned results in 2007 and 2008 and the company's profit target was significantly reduced. In this respect, the selected supply strategy has become ineffective and some financial capital was left frozen in forms of inventory and finances being received.
3. The demand forecasting analysis has shown that enterprise demand for the company's production is about 22 units per year, average sales are about 33.3 million litas. In view of the fact that in the entire analysis the efficiency of management of supply chain of one organization was studied, an assumption was made that the total annual demands were equal to the company's annual sales, and sales loss due to time constraints were regarded as negligible fact in the investigation. The assessment of economic developments and their probabilities allows concluding that in 2009 the company's sales will decline by up to 18.7 million litas, and in 2010 will decline by up to 21.5 million litas. For active response to variable demand changes the JSC "Communication Systems" is forced to consider additional raw-materials stocks, which are related to higher costs in the entire supply chain. After the analysis of occurrence of uncertainty effect of JSC "Communication Systems" the data showed that the company's orders to manufacturers exceed the consumers' orders to the company by at least 17 percent.
4. The obtained results of the research revealed the main problems of inefficiency of supply chain management: the absence of integration between strategies and action plans, as well as inaccurate sales methods. To solve these problems it is advised to adjust the forecasting model, so that on the basis of this model it would be possible to estimate the expected demand for goods and services for the forthcoming period and to appoint a responsible person to ensure the monitoring of efficiency of management of the supply chain.

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A. Rakickas, V. Lembutis

Tiekimo grandinės valdymo efektyvumo tyrimas UAB „Ryšių sistemos“ pavyzdžiu

Santrauka

Ekonominė krizė, poreikis sutaupyti, apyvartinių lėšų stygius, paklausos silpnėjimas, pinigų srautų išbalansuotumas, apsunkintos skolinimosi galimybės verčia įmones efektyviau valdyti tiekimo grandinę. Tiekimo grandinės valdymas tebėra aktualus diskusijų objektas. Mokslininkai Forrester (1958), Rayport, Sviokla (1994), Cooper, Lambert, Pagh (1997), Aitken (1998), Chen, Drezner, Ryan (2000), Christopher, Towill, (2001), Holweg (2006), Lee, Padmanabhan, Whang (2007), Lambert (2008) tiekimo grandinės valdymo procesus analizavo net tik vadybiniu aspektu per procesinį valdymą, bet ir ekonominiu, įvertinant

sukuriamą pridėtinę vertę (finansinių rodiklių pagalba), neapibrėžtumo „botago“ efekto padarinius, įmonės produkcijos paklausos prognozavimo tikslingumą. Ekonomikos teorija pati savaime neduoda atsakymo į klausimą, kaip tiekimo grandinės valdymo procesą padaryti efektyvų, tačiau padeda rasti sritis, kuriose pastebimi trūkumai. Savo ruožtu vadybos sritys dėl nepakankamo ekonominio vertinimo gali negauti norimo rezultato, patirti laikinų sutrikimų ar net didelių nuostolių. Lietuvos mastu tokia ekonomikos ir vadybos mokslų modeliavimo filosofija tiekimo valdymo procesuose yra ganėtinai nauja kryptis ir

jos menka patirtis tampa aktuali problema plėtojant verslą. Tyrimų stoka suteikia problemai naujumo ir plačias mokslinės analizės kryptis.

Viena taikomojo mokslo krypčių – UAB „Ryšių sistemos“ tiekimo grandinės valdymo efektyvumo analizė. Analizė atlikta identifikavus tiekimo grandinės valdymo paradigmą ir autorių pateiktu tiekimo grandinės valdymo efektyvumo triados modeliu, apimančiu finansinės analizės, paklausos prognozavimo ir neapibrėžtumo („bota-go“) efekto sritis.

Nustatyta, kad tiekimo grandinės valdymas apima organizacijos verslo procesus ir išeina už jos ribų, įtraukiant įmonių tinklą, reikalingą sukurti galutinei prekei ar paslaugai. Tiekimo grandinės valdymo pagalba integruotai renkama, apdorojama ir koordinuojama informacija apie visus tiekimo grandinės dalyvius. Siekiant įvertinti tiekimo grandinės valdymo efektyvumą, organizacijoje sudarytas tiekimo grandinės valdymo efektyvumo modelis.

Modelio patikrinimui tyrimo objektu buvo pasirinkta organizacija, siūlanti televizinių kompleksų gaminto, projektavimo ir diegimo paslaugas. Tai gana sudėtinga ir žinioms imli pramonės šaka, kurios veiklos specifika reikalauja aukšto kompetencijos lygio, intensyvaus informacijos srautų valdymo, aktyvaus dinaminio požiūrio ir visų įmonės grandžių glaudaus bendravimo. Atsižvelgiant į akcininkų ir vadovų pageidavimą dėl informacijos konfidencialumo, tikrasis įmonės pavadinimas buvo pakeistas į UAB „Ryšių sistemos“.

Apibendrinant UAB „Ryšių sistemos“ finansinių rodiklių, naudojamų tiekimo grandinės valdymo efektyvumo vertinimui, analizės rezultatus, nustatyta, kad 2006 m. įmonei finansiniu aspektu buvo itin sėkmingi. Remdamiesi 2006 m. pasiekimais ir išaugusiu produkcijos pardavimų skaičiumi, įmonė neatidžiai planavo kitų laikotarpių rezultatus, todėl sudaryta planinė strategija pasirodė per daug optimistinė ir neleido įgyvendinti užsibrėžtų tikslų. Menkai ūgtelėję įmonės pardavimai, perplanuoti atsargų kiekiai, išaugę klientų išsipareigojimai ir sumažėjęs turto

apyvartumo rodiklis indikavo, kad įmonė neįgyvendino suplanuotų 2007–2008 m. rezultatų ir gerokai sumažino įmonės pelno rodiklį. Šiuo požiūriu pasirinkta tiekimo strategija tapo neefektyvi ir dalis finansinių lėšų liko išaldytos atsargų ir debitorinių įsiskolinimų pavidalu.

Paklausos prognozavimo analizė parodė, kad paklausa įmonės produkcijai (televizinėms kilnojamos stotims) sudaro vidutiniškai 22 vienetus per metus, pardavimų vidurkis finansine išraiška sudaro 33,3 mln. litų. Vertinant paklausos prognozes, buvo atsižvelgta į faktą, kad tiriamas vienos organizacijos tiekimo grandinės valdymo efektyvumas ir laikytina, kad bendra metinė paklausa buvo lygi įmonės metiniams pardavimams, o pardavimų praradimas dėl laiko trūkumo laikytinas nereikšmingu ir esminių pokyčių tyrimui neturintčiu veiksmu. Įvertinus ekonominius pokyčius ir jų tikimybes, daroma išvada, kad 2009 m. įmonės pardavimai turėtų sumažėti iki 18,7 mln. litų, o 2010 m. – iki 21,5 mln. litų. Siekiant aktyvios reakcijos į nepastovius paklausos pokyčius, UAB „Ryšių sistemos“ priversta laikyti papildomas žaliavų atsargas, kurios siejamos su didesnėmis sąnaudomis visoje tiekimo grandinėje. Atlikus neapibrėžtumo efekto pasireiškimo UAB „Ryšių sistemos“ analizę nustatyta, kad įmonės UAB „Ryšių sistemos“ pateikiami užsakymai gamintojui mažiausiai 17 proc. viršijo vartotojų įmonei pateikiamų užsakymų skaičių.

Atsižvelgiant į tyrimo rezultatus, išryškėjo pagrindinės tiekimo grandinės valdymo neefektyvumo problemos: strategijų bei veiklos planų integracijos nebuvimas ir netikslūs pardavimų metodai. Šiuos nesklaidumus siūlytina spręsti tikslinant prognostinį modelį, kuriuo remiantis būtų galima numatyti laukiamą produkcijos ir paslaugų paklausos lygį per būsimą laikotarpį ir skirti atsakingą asmenį tiekimo grandinės efektyvaus valdymo stebėsenai užtikrinti.

Pagrindiniai žodžiai: tiekimo grandinė, tiekimo grandinės valdymas, tiekimo grandinės procesai, tiekimo grandinės valdymo efektyvumas.