IT in the SCM System as a Factor in Creating Added Value

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1. Introduction

Physical distribution starts in a factory. However at present physical distribution has expanded into a wider concept of the supply chain management (SCM). SCM starts prior to physical distribution. Overview of supply chain management can enable a firm to recognize the best suppliers and distributors and help them to improve productivity, which eventually results in the reduction of costs.

Market logistics includes planning the infrastructure which would meet demand, then implementing and controlling the physical flow of materials and final products from the point of origin to the point of use and finally fulfilling customer demands and making profit.

Requirements of market logistics appeal to integrated logistic systems (ILS) which encompass management of the materials, systems of material flow and physical distribution supported by information technology (IT). Information systems play a crucial role in the management of market logistics, particularly computers, POS terminals, unique bar codes of the products, satellite monitoring, electronic data interchange – EDI and electronic funds transfer – EFD. These technologies have reduced the time of fulfilling an order, decreased the amount of administrative jobs and number of mistakes in documents. They also enabled improvement in the operation control.

Activities of supply chain management - SCM involve finding logistic partners for long-term cooperation, co-creating logistic processes along integrated, digitalized supply chains, and agreeing on binding rules on commercial and data flows (Jirik, Krüeuger and Steven, Schinzer, Weber).

This work is an attempt to represent ways in which application of information technology improves SCM, as the most important element of the complete supply chain. Optimal ways of networking business logistics in the economic subjects are presented in the work. Such networking of the SCM system which is interpreted in its wider sense here enables feedback with financial business, accountancy, control and revision, R&D sector i.e. all knowledge and activities which support performing basic activity of a firm. In that way SCM transcends traditional understanding of logistics as traditional spatial-chronological transformation of goods (Sundać and Fatur, 2004) and it is understood as an inevitable and most important segment of the value chain as an instrument of identification of ways of creating greater value for a customer (Porter, 1985).

Basic hypothesis presented in this work is that IT is a crucial factor in creating an optimal system of business logistics, within which the represented system is not only optimized and networked, but it also functions as one of crucial factors of creating added value in accordance with Kumar's 3V model: 1. Define the segment of value or clients (their needs); 2. Define value proposition; 3. Define network of values which will deliver the promised service (Kumar, 2004).

2. Basic Hypotheses and Research Objectives

Hypotheses on which this paper is based are as follows:

- Logistics is at the moment one of the most important business functions.
- The development of business logistics leads to positive financial impact and increases competitive advantages of the company.
- One of the most important factors of the development of business logistics is the development of information technology in the logistics system.

The basic hypothesis of this paper is to show that an optimal chain of logistics is created by introduction of advanced information technology. Modern information technologies solve one of the main problems of logistics business system and that is a disbalance between the need for new ways for value creation and the old way of doing business. Modern technologies make accurate information available to all members of the logistics chain in a short period of time. Creation and development of an optimal logistics chain based on quality architecture of information flows enables the supply chain based on added value to be put in place. The supply chain then
becomes compatible with the value chain in the business system. The value chain of the optimal characteristics will respond to business requests of all the members as well as the final user – the customer.

In that sense, the supply chain has to function as a compact unit and a fully developed system that in turbulent and highly globalised environment brings about its meaning through the development of itself as well as through the development of its members. In that process of the development of the supply chain, the use of information technology plays the crucial role in the chain management and the communication between its members. At this point, IT takes on the character of “logistics” of the chain, that is, it becomes “logistics of the business logistics”, and the future business system development is impossible without it.

3. Business Logistics

The Concept, The Concept Development, and Understanding of the Concept

Logistics is science and activity that enables the efficiency increase and the business productivity improvement as well as the increase of the competitive advantage of a business system.

There is more than one concept of logistics. According to Zelenika (2008), logistics is a management system of the entire supply chain that includes: the transfer of raw material, semi product, reproduction material and the distribution of final products to consumers.

Logistics is accompanied by complex planning, management, operation and control of commodity flow, defining of adequate commodity and information system as well as introduction of support systems, procedures and processes.

There are various explanations of the history and the origin of the term logistics. Zekić (2001) states that the first known use of the term logistics dates back to 1670, and is found in military documents of Louis XIV. The concept of logistics includes supplying military units with the necessary material goods and providing transport for moving the military units, arms and equipment from one position to the other. Based on this source, some authors claim that the term of logistics has evolved from the French word lager which means to inhabit, to settle down or to dwell. This explanation is used as the base for simplified understanding of logistics as the function of providing material goods, shelter and transportation.

Some authors state that the concept of logistics appeared much earlier and trace it back to the emperor Leon of Byzantium (886-911) who apparently used the term to define the duty to provide the army with the arms in proportion with the need for means of protection, care for timely fulfillment of the needs of the army in the field and preparation of all army actions in military movement.

Other sources yet, associate the concept of logistics with the Napoleon’s time (Pupovac et al., 2003).

So, the concept of logistics taken originally from the military terminology has been established in the economic sector, where it is presently used as Business Logistics. The concept mainly encompasses planning, control and optimization of the flow of resources and related information flow, using at the same time the network and the equipment supporting the flow of goods, energy, information and knowledge as its infrastructure.

Source Zekić, 2001

Figure 1 Business Logistics System

Lacković (2011) states that logistics is a concept that includes the flow of goods from the supplier through the production facility and out of it, all the way to the customer.

The Council of Europe accepted the following definition of logistics: logistics can be defined as management of the goods flow and the raw material flow, processes of production of end products and associated information from the initial point to the point of final consumption, according to the need of customers (Kolanović and Badurina, 2002).
Logistics can be observed as a new way of thinking about the company, which is characterised by a comprehensive view of material, value and information flows and their optimalisation. If observed in this way, business logistics represents the integrative function in the company (Segetlija, 2002).

Such integrative function represents the evolution of the concept of logistics that took place in the 1990s. Such a view also takes into account extension of the concept of logistics outside the frame of individual company, i.e. the individual system, including all systems that operate in a particular logistics chain, independent of their interrelation (Kolanović and Badurina, 2002).

Zekić (2001) states that logistics in the modern company has to include development of a meaningful infrastructure that puts the entire supply system into service of business organisation management. (Fig. 1)

**The Purpose, The Task and The Importance of Business Logistics**

The system theory that offered the conceptual framework for study and application of business logistics also provides background for the comprehensive study of business logistics. The main idea of the application of the system theory in business economy states that the major issue is not the optimization of separate business areas but the optimisation of the business system as a whole that exists in interaction with its environment and at the same time maintains its dynamic balance.

In this way, the business logistics is viewed as application of the system theory in the area of material and information flows in a business system. Observed from the angle of functions, the fully developed logistics system represents a source of its competitive advantage for the company and the major factor of its dynamic optimalisation (Kaynak, 2002).

The importance of the business logistics study is also reflected in results of the research conducted in highly developed industrial states. According to the research, the time of the activity of circulating capital in the direct production amounts to between only 5% and maximum 10% of total reproduction process time. The rest of 90-95% of the total time represents the waiting, manipulation and transport, i.e. “logistics processes in the narrow sense of the word”.

Similarly, the productive efficiency based on specialization is not possible if the additional output does not find a customer, a beneficiary or a consumer. That is not going to be possible unless the additional output is transferred from the point of production surplus to the point of unsatisfied demand (Saki, 2002).

**4. Supply Chain Management – The Marketing Perspective**

Supply chain of a company represents development of relations with a number of “upstream” and “downstream” partners in the chain. All subjects in the canal are connected by several sorts of flows: the physical flow of products, the ownership flow (of commodity), the payment flow, the marketing flow and the information flow (Kotler et al., 2006).

It should be taken into account that “upstream” and “downstream” partners can be, and they most often are, also parts of supply chain of other companies. However, the unique structure of supply chain of a company makes a difference on which the company’s competitive advantage is based. The market success of a company is not based only on its high productivity, but also on the competitive advantage of its supply chain compared to the supply chains of the competition. For this reason the term Supply chain, that used to include only production and sales aspects of this business subsystem in a company, is at the moment observed from a wider perspective - that is as the value delivery network – made up of all the members of the channel in the supply system, that make up mutual partnerships in order to increase the efficiency of the business system.

In that sense, marketing channel management has a broader perspective and it is transformed in the concept of network that has to be managed attentively and systematically. According to this concept, the value delivery network includes not only business relations, but also value relations with other chain members. In this way, the value aspect is also added to the flow of goods, finances and information within the supply chain. (Kotler and Keller, 2008)

“Management of the demand chain does not only push things through the system, but puts an emphasises on the solution that customers are looking for, not only on the products we are trying to sell them.” (Don Schultz, Northwestern company).

Supply chain members perform many key functions as for instance: information supply, marketing, contact management, fine-tunning, negotiation, physical distribution, financing and risk taking. In task distribution process within the channel, various functions should be delegated to the channel members that can add the highest value with the same expenditure.

As the information flow is in fact the logistics base for the efficient management of all other flows in the supply chain, it turns out that the efficient management of information flows based on the modern information
technology is the key factor in creation and development of an efficient and competitive supply chain i.e. the value delivery network.

Schultz (see Troy, 2003) states that the traditional “four Ps” of marketing can be replaced with the new acronym: SIVA – Solutions, Information, Value, Access. In this way, it is noticed that information and efficient management of information flow represent one of the key factors of the applied marketing philosophy – customer oriented business philosophy.

**Information Technology as Optimalisation and Harmonisation Function of Relations in the Value Delivery Network – Bases of the Network System**

The communities are formed out of combination of persons (knots) and their relations (lines that connect them), where one community member can be a member of more communities that co-exist or overlap. (Ziegenbein, 2007) This concept represents the basis for development of network partnerships within the value delivery network.

The developed, full-fledged community (“network”) is marked by the fact that it develops unique communication patterns. In that sense, IT and quality information management contributes to efficient communication between the network members in the way that it maintains timely and systematically the information supply of all network members, which eventually encourages the development of quality relations within the network thereby strengthening the network itself. As Henry Ford put it: “Coming together is a beginning. Keeping together is progress. Working together is success.”

Network relations are based on the concept that the community is a network of large or small number or connected members who need and want some assistance, i.e. they have some mutual goals. The size of a network is based on the number and quality of persons (members); the more reliable members and the more symmetry between network members in the sense of giving and receiving, the stronger and more stable the network.

In addition, there are two other important points: focusing and open network.

Focusing means that the forces (of the network) are restricted to the essential, so that at the critical point they could be stronger than the others.

Keeping the network open is related to creation of the balance between different interests, which can interfere with the internal harmony of the community and may demand much energy to achieve balance (Jenner, Küppers).

Furthermore, there is a well-known rule named Metcalf’s Law, valid in the context of network relations: “The value of the network system grows exponentially with the addition of each unit.” (Schnetz, see in Ziegenbein, 2007). Development of the optimal information flow architecture in the network systems as well as in the value delivery network system that includes partners (subjects) in the business organisation and outside, has a positive effect on the following aspects:

- Establishing and development of the community – network
- Optimal size of the network
- Strengthening of the network due to the achieved balance (symmetry) of relations between network members
- Focusing and keeping the network open
- Harmonisation of network relations and
- Increasing the total value of the network system.

In this way, the possibility for the emergence of conflicts between members of the network is reduced. Conflicts between the members can arise due to their different interests and behaviour which are specially pronounced in case of limited transparency and objectivity of the system that can be a result of an unsatisfactory supply of information to all system members. Therefore use of IT in management of network systems contributes to establishing of the collective identity – sense of togetherness, that leads to keeping business processes within the system (network) run without stopping.

**IT in Optimal Supply Chain Management**

As mentioned earlier in the paper, the basic structure of the value delivery network consists of several logistics-interconnected and added value generating chains of more companies. From networks generated in such a way, there emerge physical supply chains and in them goods, created through multiple levels of added value, flow downstream to end customers. The main reasons for creation of a supply chain that reaches beyond the company limits are usage of common resources, supply demand synchronicity, reduction of stock reserves with related savings and increased quality level of procurement service.
The following tasks are included in supply chain management: obtaining logistics partners for long-term cooperation, co-shaping of logistics processes along integrated, digitalised supply chains and negotiation of bounding rules for commodity and data chains (Jirik, Krüger/Steven, Schnizer, and Weber).

The key elements of the system (module) in the process of shaping of the supply chain are the following (Zäpfel&Pickartz):

- Structure elements that, with regards to their organisational context, relate to operation areas in particular locations. Locations describe geographical position of particular partner weather a supplier, producer or service provider, disposition centre or a customer. Each location gets an operation area responsible for active processes of warehouse deposit, issuing goods from warehouse, exchange, transport and passive processes (storage). Planning and coordination of material flow through specific levels of added value creation chain is related, on one hand, to supply, and on the other, to residue maintenance;
- Flow elements are objects that within the flow of goods are moved, (processed or stored) from one structural element to the other. Depending on the level of being processed they include: raw material procured by the supplier, additional material and power, purchased parts and commercial goods, parts, portable parts, semi product and end products produced in one's own production that can be sold to retailers, traders or end customers;
- Process chains that connect structure element and flow elements in the sense of organisational flow. Several semi processes are necessary:
  - Procurement – source – related to procurement, storage and issuing from warehouse from the aspect of input
  - Production – make – and assemble quantity for delivery which includes production management, i.e. filling the production facilities according to exact priority rules
  - Delivery – deliver – related to tasks of issuing goods from the warehouse, packaging, invoicing and distribution of goods from the aspects of output.

In all system elements (modules) discussed above, the key issue is the use of IT as an unavoidable factor of effectiveness and efficiency increase of every described module, and of the SCM system as a whole.

Ziegenbein (2007) also states that the supply management chain for a particular event can be indicated within the system (SCEM). It is related to control and warning system based on software that switches on the alarm in case the deviation from the planned value is indicated on the checking points between commodity and production flows.

The risk of so called bullwhip effect is connected with the ineffective supply chains. According to the bullwhip effect, even small oscillation in demand of end product leads to progressive oscillations on former points of the supply chain.

The reason for bullwhip effect can be found in the fact that each partner in the supply chain can see only his own disposition area and determines the optimum quantity order i.e. the size of circuits taking into consideration only his own costs of order, replenishing and storing. Other reasons for bullwhip effect are wrong forecasts, overreactions, capacity standstill and bottleneck. (Ziegenbein, 2007)

According to Buscher, Ziegenbein suggests the following measures within the supply chain for reducing demand oscillation and therefore also reducing stock surplus and warehouse costs:

- Modular production, because same parts that are used in a large number of end products are easier to manipulate than the end products themselves;
- Fewer levels of warehousing due to keeping off manifold warehouse facilities;
- Breaking down big orders into several smaller orders with different delivery deadlines;
- Introducing permanent low cost strategy in order to avoid demand oscillation that could grow out of reduction in prices (for example quantity reduction)
- Reduction of demand uncertainty by quick response with providing data on issuing from the warehouse or sales, review of needs statistics and quality improvement and speeding up the need forecast;
- Consistent application of the withdrawal rules i.e. the product can be produced and delivered only when the next customer demands it;
- Shared data from the extranet platform and readiness for data exchange;

Each of the listed areas demands systematic and continuous use of IT that increases efficiency of the whole system.
In addition, Ziegenbein states that on the strategic level, the basic tasks of the Supply Chain Management are the following:

- Determining of strategic supply shortage (supply gap) and passing of solution measures
- Designing of procurement portfolio – a multidimensional matrix with the main axes defined as “company strength on the supply market” – the strength of the supply and the “strength of the supplier in the delivery market” – determining of the market strength portfolio and the selection of the optimal strategic option (Schultze).

In the same way with slight changes, it is possible to monitor “the strength of the logistics service provider” that results in so called logistics portfolio.

As key operative tools for determining the present state of the business system in the context of business logistics and according to above stated tasks, there have emerged suitable software packages – in other words - the various use of IT.

Furthermore, there is an understanding that the management as well as controlling of business logistics i.e. SCM should be “supported” by an adequate structure of information systems and information flows - adequate software. In this way, the requirements and the basic tasks of the supply chain will be met most efficiently. And those requirements and the basic tasks – activities of continuous measurement of efficiency (controlling) are:

- Timely identification of problems and risks in supply chain,
- Detecting possibilities for improvement and optimisation of supply system – supply chain
- Better coordination of network partners in supply chain
- Development of the system of efficiency indicators in the supply chain, and continuous efficiency monitoring of the supply chain against the stated indicators which brings about the transparency of SCM system and enables control of the critical categories in the SCM system: costs and cost generators in the system, quality of service of individual participants in the system, time consumption in the individual phases of commodity movement, (for example procurement time, production time, shortage of stock, time of demand processing) and so on
- Identification of bottlenecks and synergy potentials in the supply chain.
(Ziegenbein, according to Heckmann and Buss).

5. Issues and Challenges

The future practical research and science research are focused on research of the optimal architecture models of information flows and consequently on respective use of IT in the area of business logistics, specifically within the value delivery network system and in the realm of Supply Chain Management. The objectives of such models should explore the new ways of optimalisation of the whole system with the purpose of increasing its competition power and at the same time attaining competition advantage of the whole company.

A special challenge for the future of SCM represents so called e-logistics that includes evaluation of new types of service providers in business logistics such as:

- Fourth party logistics provider (4PLP), that manages commodity and information flows of the whole supply chain starting with the disposition and procurement of material, through storing and maintenance in the warehouse through putting on disposal in case of need.
- E-fulfilment provider that takes over the whole process of placing orders by customers started by filing orders, checking disposition of stocks in the warehouse and identifying available capacities to the delivery of goods as well as processing payment, complaints and returned goods. (Ziegenbein, 2007).

6. Conclusions

In this overview the authors have taken to review the evolution of the concept of logistics from the old use of logistics to the concept of logistics as understood at the moment. The classical concept of logistics is derived from military terminology and observes logistics exclusively as “physical”, “material” and “background activity” of the key process of a particular system. Acceptance of the concept of logistics into business economy facilitated shaping up of the contemporary concept of holistic business logistics. The process of concept evolution started with the classical, strictly physical aspect including movement of goods and money within the system of business organisation and was finalised by the contemporary, holistic perspective. From the holistic perspective, the term of business logistics actually observes the entire operation of the business system in its interaction with the dynamic environment. Such view is grounded in the system theory that sees the business system as a stochastic system with interrelated interaction of system elements as well as their interaction with the environment.
As every interactive system, the business system, viewed from this aspect, finds optimalisation of structure, procedure and process as necessary conditions for its dynamic action in competitive environment. In that process the development of adequate information flows and respective use of information technology is critical.

In that sense, the authors of this paper find that business logistics represents the key area for development of adequate information flow architecture that enables optimalisation of flows, procedures and processes that is to say an optimal system management.

In that sense, the paper presents the marketing aspect of the logistics system viewed as a subsystem – the value delivery network that is to say the management aspect which observes business logistics as the supply chain (the value chain).

The paper indicates the critical tasks and activities of the observed system and proves that the use of IT is *conditio sine qua non* of every business logistics system at the moment and without it the survival on the market in the contemporary globalised competition is virtually impossible.

In that context, IT finds its use in all areas and processes of business logistics - Supply chain management – starting with the strategic level through the operative level - including the steps of planning, observing, speeding up the process, optimalisation of flows and functioning of the system as a whole. Moreover, the use of IT surpasses the limits of “classical management of goods and services” and additionally enters the area of communication management, i.e. relations management between the partners in the system, their harmonisation and by that fashion also improving the power and efficiency of the whole system.

Finally, when the observed marketing, management and communication aspects of the development of the optimal system of business logistics and the need for the parallel development of the respective information flows are comprehended, it is evident that the use of IT surpasses the strictly speaking “management-marketing” level in the “typically technicistic sense”. The use of IT is transferred to much more subtle relations of creation and harmonisation between participants in (network) system and becomes the foundation for establishing and adding value into the business process of all system participants in the sense of achieving the major goal of the system itself and all of its participants. That goal is the delivery of *right values* to the end customer – the consumer and the search for *right solutions* that the customer needs. Without adequate information system in the present world in which the information “reigns”, this goal becomes simply unattainable.

### 7. References