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INTERDEPENDENCE BETWEEN LOGISTICS ACTIVITIES AND INFORMATION COMMUNICATION TECHNOLOGIES (ICT)

ABSTRACT

With the growing trend toward the use of international supply chains and e-commerce, logistics service providers for product warehousing, transportation and delivery are placing greater emphasis on information communication technologies (ICT) in order to remain competitive globally. In the last decades, innovative ICT have deeply affected the way business is performed and the way that organizations compete. Innovations in electronic commerce play a key role in managing inter-organizational networks of supply chain members. The internet represents a powerful technology for commerce and communication between supply chain participants as well as a technique for the improvement of supply chain management. But there are still some barriers that prevent the use of ICT in supply chains and consequently the ability to utilize all potential ICT advantages.

KEY WORDS

Information communication technology, logistics service provider, internet, supply chain

1. INTRODUCTION

Logistics activities in a supply chain include planning, designing, implementing and managing the flow and storage of materials and information exchange in order to support basic logistics functions such as procurement, distribution, transportation, inventory management, packaging, and manufacturing. One of the strategic features of logistics service providers is the employment of customer service. In order to optimally achieve this goal they must use modern logistics tools and processes. One part of my hypothesis relates to a degree of importance of information and communication technology (ICT) on logistics systems. I affirm that ICT is the most important technology for improving logistics systems, because with its proper use the productivity of constituent activities of logistics systems could be significantly enhanced. Information technologies are seen as a resource of a company, as a

source of its competitive advantage, and serve as a catalyst of change in a company. They are tools for control and management of all resources, internal and external. Adoption and successful implementation of ICT (hardware, software and network technology) are certainly prerequisites to logistics success.

Studies indicate that ICT has a positive impact on efficiency as well as the overall performance of every company that uses it, regardless of its primary activity. Logistics companies can also greatly benefit from the use of ICT. Nevertheless, results depend mostly on the level and type of ICT usage, which are correlated to a company's size and availability of technology, the integration of business processes along the supply chain is still possible just with proper use of right ICT tools and technologies. And a fact that the use of ICT requires redesign and reorganization of logistics processes, which can be seen as one of the most important barriers to ICT usage, can also be overcome in the same way.

2. ICT BENEFITS

ICT is generally seen as supportive technology (a tool) to human activities or human performance of business actions. The proper use of ICT enables faster execution of tasks and activities, accelerates data preparation and transmission times, increases the reaction speed to market needs, automates and thus lowers the costs of supervision and information processing, supports the decision-making processes, enables distributive operations enhancing efficiency, reduces data entry errors, improves the quality of customer service, reduces delivery times between date of the order and availability, facilitates payments, and improves inventory management. Companies using ICT are more capable of responding to a dynamic environment, so they can reduce more easily the operation costs. ICT technologies also constitute an essential aspect of the relationship with external partners in

that they change the nature of the relations between companies by allowing for real-time exchange of information and documentation in electronic form.

The most important elements of ICT technology, used by logistics companies, are computers, the internet, intranet and extranet, wireless communication or radio frequency systems, cellular phones, financial or accounting systems, bar coding, product scanning, laser technologies, electronic data interchange, vehicle routing, vehicle tracking systems, computer applications for fleet management and optimization of delivery tours, loading plans, transport management systems (TMS), warehouse management systems (WMS), enterprise resource planning (ERP), supply chain management software, on-board computers, hand-held computers, global positioning system (GPS) devices, automated guided vehicles, automated storage and retrieval systems, etc.

The level of ICT application can differ significantly from company to company and depends on the size of the company, its types of logistics services (warehousing or transportation), the number of product types served by a logistics company, technological development and policy on ICT, level of risks, constraints and expertise of the company. As mentioned in preliminary hypothesis, regardless of the level of ICT application its use has to be properly aligned to the required business processes to gain maximal benefits from it.

3. USE OF ICT IN LOGISTICS AREA

Transportation and warehousing are major logistics activities and major cost factors in logistics services. The primary goal of ICT use in logistics activities is therefore reduction of such logistics costs.

ICT in transportation supports information transfer, route and mode planning, choosing and delivering of products, electronic identification, mobile communication, managing claims, physical automation, tracking and tracing (long distances, multimodal transport). The most appropriate system to achieve these goals is the transportation management system (TMS). TMS offers sophisticated algorithms for transport booking, monitoring and planning. It is one of the primary systems used by logistics service providers, forwarders and carriers. In combination with mobile and wireless technology, communication networks and identification technologies can also help in better fleet visibility, reduction of paper work, and efficient communication with warehouses, providing real-time data for the use of management and decision-making. Systems like TMS can enhance the level of customer service, accuracy of all collected data (customers, products, etc.), exploitation of equipment, time and manpower; i. e., all basic preconditions for the effective operation of company.

For effective and better inventory management, warehouse activities should be supported by special warehouse management (WMS) or inventory tracking systems which provide the software to track and control the movement of inventory from receiving to shipping, through the warehouse, managing the utilization of warehouse resources such as space, personnel, and material handling equipment to improve productivity and efficiency. They are developed to support decision makers by providing consistent, timely, subject-oriented information at the required level of detail (information on inbound and outbound flows, weight and volume of stored products, type and cost of inventory, information on product design, assembly, packaging, electronic tagging, etc.). Three main benefits of these technologies are reduction of shipping errors, increase in productivity, and inventory tracking ability. The primary users of these systems are logistics service providers and wholesalers. Even better results could be obtained if WMS and inventory management systems would be supplemented by automated guided vehicles, sorting devices and automated storage and retrieval systems. In this way loading and unloading in the warehouse could be much easier and more efficient.

Future logistics and supply chain information systems should support freight and fleet management using advanced communication and intelligent transport systems (ITS) technologies. To provide an integrated logistics information network, an information network which facilitates the value-added logistics information services for both export and domestic freight movements, using one or more transport modes (trucks, rail cars, ships, airplanes), through transport infrastructure (seaports, airports) and the logistics facilities (rail terminals, truck terminals, warehouses), is needed.

4. BARRIERS TO FULL IMPLEMENTATION OF ICT IN SUPPLY CHAINS

During the past two decades, supply chain management has received increased attention among industries because it helps achieve a competitive advantage. Information sharing between link partners is one of the most important enablers for effective supply chain management. Recent advances in ICT and deployment of ICT tools in supply chains have contributed extensively toward the facilitation of this information sharing. Despite the important advantages of ICT usage in the supply chain there are (still) some significant barriers in the process of establishing ICT. These barriers influence one another and together have a negative impact on ICT capability or enable-

ment of a supply chain, because they slow down this process. It is important to determine the nature of these barriers in order to find or develop modes or strategies to tackle them.

The level of ICT implementation depends mostly on the size of the logistics company and types of logistics services this company performs. Regardless of the type of company, we can easily conclude that barriers to ICT implementation are common to all, differing only slightly in relation to company size.

Various studies indicate that lack of awareness, support and commitment of top management about use or implementation of ICT could be the most formidable barrier to its implementation. If implementation and continuous development and improvement of ICT (internally and externally) are not strategic goals of the logistics company, it is unrealistic to expect any drastic improvements in efficiency and performance.

But there are many other barriers:
- disparities of supply chain organizations,
- resistance of personnel to change to ICT supply chain management (changes in work culture and nature of work),
- integration problems in supply chain (IT infrastructure disagreement regarding the adoption and specification of the technical systems to be used, etc.),
- doubt about security and access privileges to information sources (important barrier in implementing internet and extranet technologies in the supply chain),
- costly, time-consuming and risky implementation of cross-organizational information systems,
- lack of trust in mutual connections between supply chain organizations,
- fear of information systems breakdown,
- fear of supply chain breakdown,
- lack of funds,
- insufficient or poor ICT infrastructure and resources,
- lack of qualified personnel,
- unfamiliarity of personnel with ICT software systems and tools,
- incompatibility of company with customers and suppliers,
- organizational barriers (changed roles),
- rapid obsolescence of technology,
- etc.

Barriers can be grouped by different criteria. One of them could be the source of barrier. In this case we differentiate internal and external barriers. External barriers interfere with the capability of establishing information flows among customers and/or trading partners and logistics companies. Clear information flows

are necessary for undisturbed cooperation between supply chain partners and a primary precondition for effective supply chain management. Some frequent problems are disparities of supply chain organizations, integration problems along the supply chain, fear of supply chain breakdown, etc. Internal barriers are consequences or results of internal problems, economic or organizational, and exacerbate exploitation of internal resources; they also have a negative impact on external functioning. Typical internal barriers are unfamiliarity of personnel with ICT systems and tools, lack of qualified personnel, lack of funds, fear of information system breakdown, doubt about security and access privileges to information sources, resistance of personnel to change to ICT supply chain management and others.

Another possible division of barriers is into groups of human-related and technology-related barriers. Human-related are all those barriers related to personnel, its capability to use ICT technology, fears, luck of trust, resistances, etc. On the other hand, technology-related barriers are all technical problems regarding integration of new ICT equipment and tools with legacy systems, incompatibility of systems and/or tools, rapid obsolescence of technology, disparities of supply chain organizations, etc.

We can also categorize barriers as economic, organizational or technological, depending on their consequences.

One of the big problems or threats to the most innovative logistics service providers is the speed with which ICT innovations spread and the consequently rapid obsolescence of these technologies. Logistics service providers have to develop and adopt different software applications and processes to adequately support their business activities and to gain benefits from technologies. The high speed of diffusion and multiplication of applications by computer suppliers, the need for permanent renewal of existing information systems, demand a lot of their time, money and continuous organizational changes, and lead to the emergence of new activities and the elimination of obsolete activities. So, companies may prefer subcontracting solutions or outsourcing logistics activities rather than internalizing operations that necessitate technological investments that may substantially change their ways of doing business.

5. INTERNET OR WEB SERVICES IMPACTS ON SUPPLY CHAIN MANAGEMENT

The internet provides a low cost network for business-to-business commerce transactions, so that it can be successfully employed to improve management of

supply chain systems. Because of its characteristics it is also a right tool and/or technology to overcome a number of problems and barriers cited in the previous section, which act as barriers to take all the possible advantages of adoption and implementation of ICT. The main benefit of the internet is its capacity to facilitate or speed up the integration of business processes along the supply chain by facilitating information flows that are necessary to coordinate business activities. It also allows companies to customize service solutions (i. e., increase customization in materials and processes) for their customers, which enhances the overall value and competitive position throughout the supply chain network. It allows real-time communication and interoperability between supply chain participants, so it is possible to modify raw material orders to meet demand in real time, reducing the costs of stock--outs or conversely costs associated with holding perishable inventory. Inter-company information transfer via the internet can reduce the costs of order tracking and logistics as shipments can be located *en route*.

The internet is seen as a business resource and network technology for the integration of technology at all levels of business practice. Applications of the internet; i. e., e-procurement, e-logistics, collaborative commerce, real-time demand forecasting, inventory management, true just-in-time production, customer interface, web-based package tracking, etc., can greatly affect business practices in supply chain management.

Internet and web services promise also the ability to reduce time and costs involved in developing, supporting and integrating the internal information systems within a single company and to quickly and effectively integrate information systems with those of customers, suppliers and other business partners, the primary need for cooperation between supply chain participants. As companies linked together are numerous, the connections become many-to-many, so that facilitations and services (security applications, performance measurement applications, billing and payment applications) of independent third parties are required. But there are some special conditions third party web service providers have to fulfil: they must be industry based (logistics service providers), provide specialized software and services, trusted by users, offer their services at reasonable prices.

6. CONCLUSION

ICT can have a positive impact on both front-end and back-end processing in a supply chain, because it provides all parties in a supply chain with better and real-time access to information, making logistics services more accurate, faster and cheaper. The reasons for a higher level of ICT should be the need for accurate information and higher quality customer service

levels. Factors contributing to the level of ICT implementation are size of company, technology and policy, and types of logistics services.

ICT enablement may not be the remedy for all the supply chain-related problems. However, according to the hypothesis and the facts presented in the article, it is a strategic and capital-intensive issue, and its success lies in the readiness of supply chain partners to share information for their mutual benefit. Thus, mutual trust and confidential information, along with awareness and commitment of top management are considered indispensable for the implementation of ICT software systems and tools between supply chain partners. Obviously, ICT tools that enable electronic communication between them have to be compatible, which mostly means the raising of another problem because of different levels of ICT implementation and use. As stated in previous section, the remedy for these kinds of problems could be independent third party (web) service providers that offer the possibility of the use of special services and tools without their internal implementation and the means for interconnection and real-time communication between supply chain participants, the precondition for effective performance of all logistics activities. In this way, just with proper use of the right ICT tools and technologies, it is possible to overcome the differences between supply chain or logistics partners, which are result of different levels and types of their internal ICT usage.

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POVZETEK

MEDSEBOJNA ODVISNOST MED LOGISTIČNIMI AKTIVNOSTMI IN INFORMACIJSKO KOMUNIKA-CIJSKIMI TEHNOLOGIJAMI

V času naraščajočih zahtev po internacionalizaciji in globalizaciji oskrbnih verig ter e-poslovanja postajajo tudi za ponudnike logističnih storitev informacijsko komunikacijske tehnologije sredstvo njihove globalne kompetitivnosti. V zadnjih desetletjih smo namreč priča močnemu vplivu teh inovativnih tehnologij na samo poslovanje podjetij znotraj oskrbnih verig. Med najobetavnejšimi tehnologijami je gotovo internet, ki s svojimi storitvami in orodji omogoča komunikacijo in poslovanje med člani oskrbne verige ter sredstvo za izboljšanje upravljanja oskrbne verige. Kljub obetavnim izsledkom in napovedim pa še vedno obstajajo številne ovire, ki onemagočajo dovolj visok nivo implementacije informacijsko komunikacijskih tehnologij, ki bi omogočal izkorišanje vseh prednosti, ki jih te ponujajo.

KLJUČNE BESEDE

Informacijsko komunikacijske tehnologije, spletni ponudniki logističnih storitev, internet, oskbne verige.

LITERATURE

[1] **Daniel, E. M. et al.** (2004) *"Exploring the role of third parties in inter-organizational Web service adoption."* The Journal of Enterprise Information Management, Volume 15, Number 5, pp. 351-360.

[2] **Lancioni, R. et al.** (2003). *"Internet impacts on supply chain management."* Industrial Marketing Management 32, pp. 173-175.

[3] **Lemoine, W., and L. Dagnaes** (2003). *"Globalisation strategies and business organisation of a network of logistics service providers."* International Journal of Physical Distribution & Logistics Management, Volume 33, Number 3, pp. 209-228.

[4] **McIvor, R., and P. Humphreys** (2004). *"The implications of electronic B2B intermediaries for the buyer-supplier interface."* International Journal of Operations & Production Management, volume 24, Number 3, pp. 241-269.