IMPLEMENTATION OF RFID TECHNOLOGY IN SUPPLY CHAIN MANAGEMENT

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Abstract

The globalization of markets and new technological innovations exert influence on the development of new models and structures in supply chains. The role of integrated supply chain will strengthen in the future that will initiate a new role in functioning and development of marketing channels. The processes of globalization of markets will fully promote a numerous horizontal and vertical integrations in the supply chain management. Integration of the total supply chain of products is focused on retailers that are able to estimate accurately future sales trends. Electronic commerce business activities relate to the interaction between the various participants along the supply chain. Implementation of RFID (radio frequency identification) revolutionizes supply chain management by making it more efficient, thanks to the movement of product information between participants in the supply chain. RFID technology leads to fully reliable solutions through secure identification and monitoring of products in supply chains. These changes in supply chains come with implementation of global standards GS1 EPCglobal, which consists of a combination of radio frequency identification, using the existing communication networks and electronic product coding. Thanks to the new GS1 EPCglobal system, opportunity for identifying a unit of the product is created along the entire supply chain in marketing channels. RFID technology has completely changed the interrelationship in the supply chain management due to global standards of radio frequency identification GS1 EPCglobal.

Keywords: global market, supply chains, electronic commerce, RFID, GS1 EPC Global

1. INTRODUCTION

Macro environment is substantially altered by the complexity of the market, scientific and technological progress, legal regulations and the effects of trade policy, and influence the development of new models and the structure of supply chains. New principles become important, which relate to the maximum market flexibility and long-term competitive advantages based on the latest scientific and technological achievements. In order to ensure competitiveness in the global market in terms of the constant influence of macro environmental factors on integration of the supply chain, it is necessary to provide answers to the following questions:

- What is the impact and importance of the global market and new technological innovations in the development of new models and the structure of the supply chain?
- How is the RFID technology revolutionizing supply chain management?
- What allows the identification of unit product along the entire supply chain in marketing channels?
- What are the key changes in the relationship between participants in supply chain management?

The above-mentioned questions point to technological innovations in supply chain management, which requires constant change of business strategy in order to maintain compliance with the macro-environment. The basis of GS1 center and its network of national GS1 associations are the development and implementation of global standards in order to improve operations in the supply chain in the global market. The cooperation with institutions for standardization, professional associations and other organizations, GS1 leads to the development and application of standards in the supply chain, with the main aim to unify business communications. Activities of GS1 Serbia are part of the Commission for the automatic identification and data capture at the Institute for Standardization of Serbia (ISS), which work on international standards ISO/IEC JTC 1/SC 31 (AIDC) and CEN/TC 225 (AIDC technologies). GS1 Serbia offers five different ranges of bar code numbers, where the articles with variable weight are assigned with bar code prefix GS1/EAN 27, and logistic units (collective packages and pallets) with GS1/EAN 128 code.

2. THE IMPACT OF MARKET GLOBALIZATION AND INNOVATIONS ON THE STRUCTURE OF SUPPLY CHAINS

The impact of market globalization and new technological innovation lead to the development of multi-channel strategies, which as a result has a set of marketing channels, which makes products and services available to consumers in a convenient way, daily or in long term. Internet based marketing channels become main channels of many organizations. In the context of multi-channel strategy, synergy means the use of one channel for improving the efficiency and effectiveness of the other channels in the mix (Rosenbloom, 2013, p. 8). The strategy of marketing channels, especially multichannel strategy, has attracted considerable attention as a means to achieve sustainable competitive advantages in the structure of supply chains. Multi-channel strategy involves tracking the movement of products through multiple channels, integration of information and having information available for decision-making. Therefore, it is necessary to implement an identification systemthat will be compatible to all participants in the supply chain on the global market.

The global electronic market has the characteristics of a free market and free sellers (Končar, 2008, p. 183). The phenomenon of e-commerce has completely changed the traditional marketing channels and supply chains. The expansion of the market comes with electronic commerce so that the market becomes global. Considering that the potential customer can be in one country, and the seller in the other, it is essential to monitor

products adequately, first to make sure that what is offered on the website is available in stock. It is necessary that the consumer know where the product is during delivery, and at the end to be sure that the product will come on time and in adequate form to the consumer. In order to follow this complex system of supply chain on the global level, it is necessary to have a consistent system for identifying products that will be supported throughout the structure of the supply chain.

The structure of supply chain on the global market implies the strong long-term relationship between the participants. The question is which participant is the holder of the implementation of new technological innovations in identifying items in the supply chain. The position of some participants in marketing channels means strengthening in contemporary conditions. Manufacturers with a strong manufacturing brand implement technological innovation and in the exchange of information with their partners in the supply chain. The goal is rapid exchange of information in order to deliver a product to the right consumer, in the place and at the right time. On the other hand, strong retailers invest in products in stores. In order to have an efficient supply chain, retailers monitor and identify products in collaboration with their suppliers, which have the character of permanent supplier. The focus is on the consumer with tendency to respond adequately to consumer's needs, to respond quickly to demand, altogether with the rationalization of processes and lower costs.



Figure 1 Sector EPCglobal members

Networking supply chain is established with the aim of rationalizing the process, the unique identification, effective exchange of information, an adequate response to consumer demand, etc. If we observe the activities of the participants who are members of EPCglobal, we can see that the majority of companies are in the sectors relating to final consumption. Retailers occupy only 2%, which is mostly caused with process of concentration in retailing that resulted with small number of huge retailers. Sectors such as consumer goods, food and

Source: Thiesse et al., 2011, p. 330

beverage, and footwear and apparel are also participants connected with retail sector. Retailers who are EPCglobal members and the initiators of identification systems application are the largest trading company in the world that work globally, such as Wal-Mart, Carrefour, Tesco and Metro and they have a significant share in the total retail income.

3. CHARACTERISTICS OF IMPLEMENTATION OF THE RFID TECHNOLOGY

RFID technology is a relatively new technology of radio frequency identification, which allows tracking of products and their identification using radio waves. Incorporating RFID tags or labels enables the transfer of information using radio waves to electronic readers, thus creating the conditions for products with embedded chips to be scanned remotely. There are many applications for RFID technology, but in the context of marketing channel management, core applications relate to inventory tracking, supply chain management and increasing the efficiency of the buying process in retail (Rosenbloom, 2013, p. 93). RFID technology is truly revolutionizing not only the control of inventory in supply channels, but also the complete purchasing process in retailing.

Radio waves are used as the basic medium, and the entire technology is based on microchip antenna, electronic product code and the wireless computer. Electronic Product Code (EPC) includes a variant of RFID technology resulted from the UPC. Basically, there are active and passive labels (Rosenbloom, 2013, p. 510). Passive RFID labels include small microchips where the encoded information is read when the chips are scanned from pallets, boxes or individual product. The reader converts the code into identifiable information (ex. where the product is, where it is being directed, and so on.). In contrast to the passive ones, active RFID labels require a power source and they are larger, more expensive and have much longer range than passive. In an active system, the battery in the RFID tag indicates the effective range of geographic labels and supports other features that are not possible with passive labels, such as sensitivity to temperature changes in the environment (Rosenbloom, 2013, p. 412). Data from the RFID tags come to the main computer through communication interfaces, which is almost identical as the bar code label, and sends data to computer systems for interpretation, storage and the overall activities relating to it.

RFID technology has been adopted by many major retailers (Metro, Tesco and Wal-Mart), because it allows the elimination of the lack in monitoring the stock, reduces control and comes to the integration of the supply chain. Intensive globalization in retailing requires improvement in supply chain efficiency. In the retail supply chains, four areas have the major priority: inventory management, storage management, demand planning and transport management. The advantages of RFID in automated data collection relate to elimination of the labor force in monitoring the inventory in retail. Thanks to RFID, technology retailers create conditions for improved collaborative planning, forecasting and inventory management with benefits and cost savings. That means a reduction in labor costs, and also administrative costs, while IT benefits are manifested in easier monitoring and making reports (Thiesse et al., 2011, p. 333). In that way, the value of information grows, information can be easily collected and stored, in order to respond adequately to rapid changes in demand and make quick business decisions.

RFID is considered as technology that intensifies cooperation and coordination of the participants in the supply chain due to better visibility of the physical processes in the supply chain. Research, implementation, testing and funding of innovative technologies such as RFID is linked to the large retail companies that have the financial resources for technology development. Retail companies have a difficult task to convince their suppliers and intermediaries, as well as companies from other industries about the benefits of RFID technology and the feasibility of investing in its implementation. RFID technology is the most important technology for the Metro Group (Metro Group, 2013). With it, the data is retrieved and transmitted on a chip that is built-in thin labels, which are on logistic units such as pallets. This chip saves the product number, which contains a bar code and serial number. In this way, each object equipped with this chip, is contained in the database, has its own "identity" and cannot be replaced by any other. The code is read wirelessly using radio frequency identification devices, and then this information is regulated by special software, which stores it in the database. The shipment of a product from the manufacturer to market can be followed in the database. Thus, all participants in the supply chain, manufacturers, suppliers and retailers, know where the goods are located at any time.

4. GS1 EPCGLOBAL STANDARD IN SUPPLY CHAIN

Identification of products through GS1 standards is much more than identifying and scanning products, thanks to global standards, thus creating the possibility of establishing a global market. The GS1 company prefix assigned to company allows each company to create any GS1 identification key such as GTIN (Global Trade Item Number), GLN (Global Location Number), SSCC (Serial Shipping Container Code), GRAI (Global Returnable Asset Identifier), GIAI (Global Individual Asset Identifier), GSRN (Global Service Relation Number) and GDTI (Global Document Type Identifier) (GS1, Annual Report 2012-13). All participants in the supply chain with selected standards identify products, thanks to global standards, which are now known as GS1 bar code. The GS1 identification system becomes the base of business processes for most users by creating efficiency in the supply chain. The most important solutions of GS1 are (GS1, About EPCglobal 2012):

- GS1 DataBar is the "reduced" next generation of GS1 bar code. It is smaller than the original bar code, but it may contain more information. According to GS1 survey, the average retail chain with 100 buildings, a GS1 DataBar generates annual operating savings of more than \$ 2,320,000 in meat sells.
- Electronic Product Code (EPC) uses tags with radio frequency identification (RFID tags), enabling visibility and efficiency throughout the supply chain and higher quality information flow between companies and their key trading partners.
- GS1 eCom standards provide clear instructions for creating electronic versions of all types of business documents, so that business partners can exchange easily and freely information electronically, regardless of the mother tongue of employees, or sort of internal hardware/software system they use.
- GS1 GDSN (Global Data Synchronisation Network) provides a powerful environment for secure and continuous synchronization of accurate main data about the items and companies.

The GS1 is focused on constant innovation and continuous global language of business because of the development of new digital trends and mobile technologies. The GS1 Source includes the standards based on product information that consumers need in the digital marketing channels. Thanks to the GS1 Source, a network of data aggregators is made to store information about a number of products, with global index that tracks the information. With the implementation of GS1 Source brand owners have the following benefits: increase in sales, brand protection, positive experience, the ability to connect digitally, multi-channel world, providing customers an optimal experience, increase the efficiency of its operations and compliance with national regulations (about benefits on GS1 EPCglobal, 2012). EPCglobal exerts influence on the development of standards for the implementation of the radio frequency identification (RFID) technology in the supply chain in order to meet the needs of all participants in the supply chain.

The EPCglobal identifies automatically information in the supply chain at any location. The EPCglobal network is a framework that allows immediate, automatic identification and sharing of information in the supply chain (GS1 EPCglobal, About EPCglobal, 2012, p. 2). EPCglobal network identify automatically any item in the supply chain in the global market. The reasons for the use of EPCglobal are usually (Thiesse et al., 2011, p. 336): recommendations by an industry association, further (expected) governmental regulations, internal decision process, mandate of a consumer, further (expected) requirements of consumer.

GS1 logistics label provides clear and consistent information to ensure individual monitoring trends in the supply chain about the delivered units. Each logistic unit must be marked with a unique serial number SSCC (Serial Shipping Container Code). The SSCC is used to identify logistics units (in transport and storage), enables individual monitoring of each unit which creates the possibility of implementation a wide range of applications such as docking, shipment routing, automated reception, and the like.

Application Identifier			
	Additional number	GS1 company prefix Reference unit	Control number
0 0	N ₁	N2 N3 N4 N5 N6 N7 N8 N9 N10 N11 N12 N13 N14 N15 N16 N17	N ₁₈

Figure 2 GS1 identification number known as SSCC for identification of logistic units

Source: Končar, 2008, p. 100

The SSCC combined with bar coding and EDI technology enable monitoring the transport unit along the supply chain and the full identification of each container and pallet (see Figure 3). The SSCC identifies uniquely each transport package, which is different from the other, during its life circle. Therefore, we can say that the transport packaging makes a special unit, which is completely independent to the sender or, to the recipient. All participants in the supply chain use it, and each shipping container that has specific properties compared to other gets its SSCC (Končar, 2008, p. 101). The SSCC is required data on the logistic label, and it consists of an additional number, GS1 Company Prefix, the serial number and control number (Figure 2).

The GLN (Global Location Number) is used for identification of any locations for the supply chain using. In Serbia, the GS1 GLN organization is a national database and

assigned the GLN to its members. The GLN identifies the physical location of the real entity in order take a single record of the subjects' location.



Source: "Coding of Shipping Containers and Pallets: Use of Als and EAN-128", 1994, p. 8

Serial Shipping Container Code is designed in accordance with ISO/IEC 15459 standard, which includes the concept of a unique number to identify logistics units. Regarding the number of trade items, additional information that can be presented and contained in a logistic unit are customer purchase order number, location numbers, and other attribute data (lot number, date, logistical measures, etc.). Identifying and tracking the movement of goods makes the basis of supply chain management, which leads to the increased use of logistic labels in order to follow pallets and other logistics units by the global identification.

5. IMPLEMENTATION OF B2C GS1 SOURCE PROJECT OF PRODUCT INFORMATION EXCHANGE

Contemporary supply chains include the involvement of consumers in the exchange of product information. The GS1 Source creates an environment in which it is possible to exchange product information in the digital world. It is based on GS1 standards and the Internet, thanks to which consumers can access to information about the product. For the implementation of GS1 Source, the involvement of all stakeholders is required in the supply chain, from manufacturers, retailers, service providers who create applications for e-commerce and mobile commerce, and consumers that have the requirements for specific information about the product, as well as the government issuing the regulations. In modern conditions, there is some change in the mode of communication between suppliers and consumers. It exceeds the mass communication, and enters various interactive digital methods of transmission of information via the Internet and mobile media. Mobile phones are used for Internet access, scanning bar codes and QR codes, due to which the consumer receives the information about the product and becomes closer to the product.

The communication in multi-channel and digital channel performance is done through GS1 Source, so that product information flows in order to increase sales, because the increasing availability of information leads to more sales. In order to buy online, consumer must have adequate information about the products.



Figure 4 GS1 Source infrastructure

Source: GS1 EPCglobal, GS1 Source, [available at: www.gs1.org/source, access 08.06.2013.]

GS1 Source is based on GS1 standards and a set of stored data. Multi-channel retailers create opportunities for consumers to explore and perform activities of purchase online, thanks to digital availability of accurate information about individual products. The GS1 organization is directed increasingly to the global GS1 B2C Source development of global standards, which has become operational model guidance.

Mobile phone technology allows the consumer to be in contact with the product. The consumer with a mobile phone approaches to products, records the bar code and QR code, and after a few seconds, he receives directly from the manufacturer the information necessary to make purchasing decisions. The GS1 has established a working group GS1 Mobile Com, which satisfying the needs of consumers, manufacturers, service providers and retailers to use mobile phones, which are currently applied to the local market, but still missing the global standards. Consumers come to the information about the product via their mobile phone by scanning. New applications in the mobile commerce will provide consumers a consistent approach to the market via mobile phones.

6. CONCLUSION

The position of participants in marketing channels is strengthening in contemporary conditions. In order to have an efficient supply chain, retailers monitor and identify products in collaboration with their suppliers. The focus is on the consumer with tendency to respond adequately and quickly to consumer's needs, altogether with the rationalization

of processes and lower costs. RFID is considered as technology that intensifies cooperation and coordination of the participants in the supply chain. Thanks to RFID the value of information grows and can be easily collected and stored. The GS1 is focused on constant innovation and continuous global language of business because of the development of new digital trends and mobile technologies. The EPCglobal identifies automatically information in the supply chain at any location. GS1 logistics label provides clear and consistent information to ensure individual monitoring in the supply chain. GS1 Source is based on GS1 standards. Multi-channel retailers create opportunities for consumers to explore and perform activities of purchase online, thanks to digital availability of accurate information about individual products.

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