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INFORMATION TECHNOLOGIES IN LOGISTICS AND THEIR CONTRIBUTION FOR COMPETITIVENESS IMPROVEMENT OF COMPANIES

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Abstract. Fundamental changes have occurred in today’s economy. These changes alter the relationship we have with our customers, our suppliers, our business partners and our colleagues. IT developments have presented companies with unprecedented opportunities to gain competitive advantage. So IT investment is the pre-requisite thing for each firm in order to sustain in the market. The cost of information is decreased due to the increasing rate of technologies. In an integrated supply chain where materials and information flow in a bi-directional, Manager needs to understand that information technology is more than just computers. As computing power has grown and prices have dropped, sophisticated computer resources are now within reach of even the smallest organization. Information transfer can occur instantaneously, not only within single organizations, but also between them. This capability means that data are captured and analyzed more quickly, leading to better decision making.

This work aims to study the influence of Information Technologies on the competitiveness of logistics companies. That is, it intends to analyse if the adoption of Information Technologies contributes to improve costs, time and customer service. To attain this objective a content analysis methodology is used. Results indicate that there is a positive relation between the adoption of technologies, namely RFID and the competitiveness of companies. Radio frequency identification utilizes a small transmitter to send radio frequencies from pallets and cases that allow those items to be instantaneously located by the customer or the carrier [16]. As the information technologies have been considered very important for businesses it is crucial to improve our understanding on the main advantages associates with them and their contribution for competitiveness improvement of companies and supply chains, so this paper represents an important contribution for academics in this field.

Key words: information technologies, supply chain, electronic information, Radio Frequency Identification.

Introduction

Today’s world economy is known by the pressure caused by strong competition, constant shifts and a high level of uncertainty and market unpredictability. Besides, the market’s offered product variety keeps rising, by which it adds difficulties when administrating the information flow throughout the supply chain, forcing the introduction of new technologies to ease logistic operations towards manufacturers [6]. This way, it can be claimed that all companies are exposed to technologies’ developments, being its application obvious on every level of the supply chain, including on communications with suppliers, producers, in the relationship with the clients [3], as well as on global logistics management, especially on world distribution coordination, product design, production, shopping and inventories.

Main part. IT’s can be defined as the technological side of an information system, which includes the hardware, data bases, software, networks and other devices. According to several researchers, IT’s have been being the essential infrastructure in competitiveness and cooperation amongst companies, having positive effects on the supply chain’s performance [11], on the achievement of competitive advantage, amongst other benefits:

- More efficient results;

- Global error reduction;
- Increasing quality of the business’s execution process;
- Satisfaction increasing and relationship engagement;
- Learning and organizational memory increase;
- Strategic benefits that lead to the companies’ competitive advantage [7];
- Innovation in several products and services, enabling the appearance of some important capacities (information delivery online; electronic access to services; ability to request and obtain specific services; payments and electronic billing presentation) [14].;
- Easy access to some markets;
- Entry barriers establishment;
- Data storage from an external environment (database).

After being recognized the IT’s rising importance towards companies, it is now important to analyse in detail the technologies that allow to support the companies’ and their respective supply chain’s competitive advantage. Part of the analysed technologies that will be analysed here are: 1) Radio Frequency Identification (RFID); 2) Augmented Reality (A.R.). In this work the first one is analysed widely.

RFID is a wireless identification technology that allows electronic information communication when associated to physical items [5]. RFID’s main component is the smart tag fixated in the product. The electronic information is identified on the tag and after is collected through electromagnetic devices, which goes to a radio transmitter where a radiofrequency holder transmits to a possibly distant receptor, designated as reader, capable of interpreting and registering information. RFID system is basically made out of three elements: tags, electromagnetic data readers and a series of computational programmes. When the tag passes through the external electronic reader, the data on the tag’s memory are recovered and then transmitted. This memory consists in an integrated circuit or microchip and has the capacity to store a considerable amount of information, like in this case:

- Electronic code of a specific product;
- A product’s reference code;

- Production data;
- Delivery dates;
- Expiration dates;
- Suppliers’ information.

There exist numerous studies on possible companies’ winnings in case they adopt RFID; in the same way, it is equally common to find out other studies that prove the fact that RFID has not yet presented results that reveal its implementation as a benefit. The reality is that the possible generated benefit will always be different between companies, even that they are in the same market segment. Like any other technology, its capacity to generate value is not exclusively relying on technical factors, but also on economical and organizational factors.

On the supply chain level, several activities have been being applied, from production, distribution, transportation and retail, being its improvements presented in the following table (Table 1) [8].

Table 1.

Advantages associated to RFID usage

User	Advantage
Suppliers	Inventory More information about the inventory; More effective decisions on replenishment; Decreasing inventory levels. Operational Increasing productivity [2]; Upgrade on the material/product movement tracing, which leads to an efficiency raising on order accomplishment; Higher quality and trust of the product; Higher profit margins as a result of cost reduction; Cost reduction on technical help.
Distributers	Inventory More information on the inventory (quantity and tracing) [1]; Loss reduction. Information Less possibilities of inventory recount; Data gathering efficiency (possibility to read multiple tags simultaneously and without requiring to manoeuvre articles to reach the line of sight) [10]. Delivery Better management of the storage and transportation channels; Higher delivery precision levels.
Tenants	Service Level Customer service improvement [9]; Better identification of the target audience; Easier identification of the clients’ needs [15]; Better product display on the shelves [2]. Inventory Improvements on obtaining consume data. Information Faster data recollecting. Security Theft decrease; Product veracity verification, which allows forgery discovery.

Even though RFID is starting to be seen as promising and versatile technology, there also exist some disadvantages/limitations on adopting it:

- High hardware and software costs [12];
- Costs by applying tags on products;
- System installing costs;

- Costs on training and reorganizing the team;
- Resistance towards cooperation amongst the supply chain’s different levels [18];

- Interference that may difficult the transmission between the tag and the reader [4];
- Lack of RFID professionals;
- Consumers’ privacy violation;
- Lack of tag patterns on a world level;
- The collected data are not standardized, which demands the implementation of a specific software that takes care of formatting;
- Possibility of having twisted tags due to the products’ characteristics where they are applied on;
- The range of products that reach extreme temperatures may damage the tag.

Radio Frequency Identification (RFID) – RFID is an Automatic Identification and Data Capture (AIDC) technology. RFID first appeared in tracking and access applications during 1980[20]. RFID-based systems allow for noncontact reading and are effective in manufacturing and other hostile environment where bar codes could not survive. These are used as an alternative to Barcodes to communicate the inventory data to the reader via radio waves. RFID wirelessly exchanges information between a tagged object and a reader.

An RFID system is compromised of the following components as mentioned below.

- One or more tags called Radio Frequency Tags (RFTs), which includes a semiconductor chip and antenna.
- One or more read/write devices also called readers.
- Two or more antennas one on the tag and one on the reader.
- Application software and the host computer system.

The reader is connected to the central computer. Radio Frequency Tags (RFTs) are a piece of silicon chip to store data in the microcircuit. The RFTs are programmable with erasable memory. Data is stored in coded form and communicated to the reader through waves. The basic principle of tag is that antenna emits the radio signals. RFTs are very useful to accompany truck shipments. The tag will contain information on consignor, consignee, inventory items, quantity and value, what time the item travelled certain zone; even the temperature etc. The reader receives the tag signal with its antenna, decodes it and transfers the data to the host computer system. RFTs can be attached to virtually anything-from a semitractor, to a pallet, containers etc. RFTs will avoid paperwork and can be helpful in quick clearance at custom posts. In the warehouse, the barcodes can be applied to the individual inventory items while RFTs can be applied to pallets, containers etc. These will allow the staff to directly communicate to the warehouse computer [13].

RFID has significant impact on logistics and supply chain of many sectors:

- Improve the ability of manufacturers to better manage the inventory levels.

- Improve the complex distribution system for the Defense operation.
- Improve the complex tracking and distribution operations of the Postal services.
- Improve the tracking, logistics and planning operations of Railways, state public transport agencies
- Implement automatic toll collection on vast network of highways. [19].

As previously discussed, RFID refers to the electronic tagging of pieces, boxes, pallets, or equipment with a device that utilizes a radio signal to transmit information regarding location, contents and movement. These transmissions can be read at any point in the shipping process to provide instantaneous, real-time information about the status of the items from which they are emanating [17]. The implications for use on ocean containers, for instance, are staggering. Not only could specific containers be located quickly, but the contents of each unit could be ascertained as well.

Conclusion

Companies nowadays are branded by consumption general increase and the appearance of new products with shorter lifecycles, as well as they’re affected by consumers’ profile changes, finding them more and more demanding.

Facing such reality, all companies desire to differentiate from their competition in order to emphasize the position in the market. Due to the globalization phenomena, the complexity level of supply chains has been rising, what means a greater difficulty for companies to efficiently manage a complex entities network that may be geographically distant, which makes trades and flow management being something difficult financially, informatively and physically. It is through the supply chain that companies are able to manage and structure easily the relationships with their partners, reaching competitive advantage.

So, competitive advantage is obtained through strengthening every activities’ being inside the company’s value chain, from production to commercialization, making possible to position the company and create a base of values that distinguishes it from its opponents. Within this need of competitive advantage winnings/maintenance, IT’s revealed as a tool to attain a competitive differential between companies, being considered as a vehicle that allows improvements on inventory management, customers’ relationship and satisfaction and even costs reduction. This way, IT’s should be present supply chain’s levels, since they are considered resources capable of providing a superior value to the company, facing a dynamic market. With that being said, this study has searched to identify conceptually the influence that several IT’s, like RFID, had on companies’/supply chains’ competitiveness improvement. For that, several investigation propositions were raised through study

cases' and secondary sources analysis, in order to analyse the felt impacts.

The main results show that through IT's adoption it is possible to reach improvements on costs reduction, time and service quality improvements. In that sense, the analysed companies on RFID usage achieved: 1) cost reductions through processes improvement, as in automation; 2) time reductions on inventory management improvements, inventory loss decrease and stock location easiness; 3) service quality improvements through customers' satisfaction raise, thanks to a better identification on the clients' needs.

Since this study only focused on a perspective of how IT's grant competitive advantage winnings against opponents, it would make sense to be developed a research on performances which includes productive cycle's time and costs reductions and quality improvement as indicators.

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