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INFORMATION TECHNOLOGY AND SUPPLY CHAIN MANAGEMENT IN TOURISM

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Abstract

Today the supply of tourist centres and destinations takes place through supply chains that connect different suppliers, manufacturers, distributors, logistics companies, and tourism and hospitality. The main task and objective of the supply chain is to deliver the right products and services to the right place at the right time in the right quality and at acceptable costs. To fulfil the said objectives and tasks, it is necessary to manage all processes and activities in the supply chain. Effective management cannot be imagined without the use of modern information technology and systems. The objective of this paper is to present in detail new information and logistics solutions that are used in the process of selling products and services, i.e. the supply of tourism and hospitality systems. Different solutions based on sensor technologies and devices, RFID technology and barcode systems, which are used for the identification and monitoring of processes, activities and products in various stages of the supply chain, will be presented. The application of information technology and systems ensures cost efficiency monitoring and increases visibility and security of supply chains in tourism.

Introduction

Accelerated tourism development and growing competition in this area have forced numerous tourism organizations to look for ways to improve their position in the tourism market. This is most often achieved by using

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new technologies and strategies. The new solutions are mainly based on information technology used in various segments of the business of touristic operators and organizations. An important precondition for the development of tourism, the competitiveness of the tourist destination, as well as customer satisfaction is the efficient development of supply chains. It is necessary to manage supply chains in order to provide the offer of tourist destinations, systems and facilities with the right products at the right time and in the right place with the least possible cost. Through supply chains, time and spatial transformation of material goods, information, energy, waste and capital takes place in order to provide quality tourist services at the lowest price. The main goal is to optimize the flow of goods from the place of origin to the place of consumption of goods, through production and distribution, in order to fulfil the requirements of the market with minimal costs.

Despite the great importance of logistics and supply chain for the development of tourism and supply, a lot of attention is paid to this issue. Research on supply chains and logistic processes in tourism have been relatively recent and are significantly limited. Such a situation is the result of a large number of companies in the supply chain in tourism, but they each have different objectives that are often opposite. In addition, many experts mainly focus on the marketing and sales of a tourism product, ignoring the management of a complete supply chain that significantly impacts the competitiveness of the tourist offer. The integration and coordination of all participants in the chain is very important, and enables the realization of a common goal, which is the fulfilment of the user's requirements (Odoom, 2012). This situation has to change because the logistics and supply chain management is often a prerequisite for a quality tourist service and customer satisfaction (Kilibarda et al., 2012).

It is necessary to define an appropriate logistical concept of supply chain management that will enable the increase of the competitiveness of tourist destinations and products. It is certainly not possible without the use of modern information technologies and systems. Information technologies and new digital business systems have found their wide application in online services for marketing, sales and reservation of tourist capacities. However, when it comes to supply chain management, these technologies have a very low degree of application.

The insufficient level of development of the supply chain management system and the low level of application of information technologies in the

supply of tourist destinations were a sufficient motive for the creation of this work. The authors intended to examine and present the most important problems, limitations, opportunities and solutions related to information technology and supply chain management in tourism. The paper has three basic units. The first unit refers to the definition of logistical and supply chains in tourism, the second to the basic logistical problems in the tourist region and the third to information technology and their application in the supply chain management.

Characteristics and structure of supply chain in tourism

The concept of supply chains in tourism can be considered from different perspectives. Although this is an insufficiently explored area in scientific and professional literature, there are several different definitions of this term. Among the most important definitions, the following can be distinguished: (Tadić, et al., 2012):
  - Kotler, Bowen and Makens (2006) in their presentation on marketing in tourism and hospitality industry, define a supply chain in tourism as a system that includes suppliers of all goods and services that consist of tourist products intended for consumers.
  - On the other hand, Scavarda, Lustosa and Scavarda, (2001), consider that the chain of supply in tourism, besides the supplier of all goods and services, includes the tourists themselves, as they actively participate in the production and consumption of tourist services.
  - Still, Zhang, Song and Huang (2009) presented perhaps the most comprehensive definition of this term in their publication. They defined the supply chain in tourism as a network of tourism organizations involved in various activities, from the procurement of various components of tourism products and services, such as travel and accommodation, to the distribution of the final tourist product to specific tourist destinations, and which involves a large number of participants in both private and public.

Generally, the type of product greatly influences the characteristics of the supply chain. When it comes to tourism, the supply chain includes all categories of suppliers of goods and services that participate in the creation and delivery of tourism products. In order to adequately analyse the characteristics of logistics in tourism and in order to perform successful supply chain management, it is necessary to know the specifics of tourism and tourism products. In other words, tourism has certain characteristics, from a logistic point of view, which are specific only to
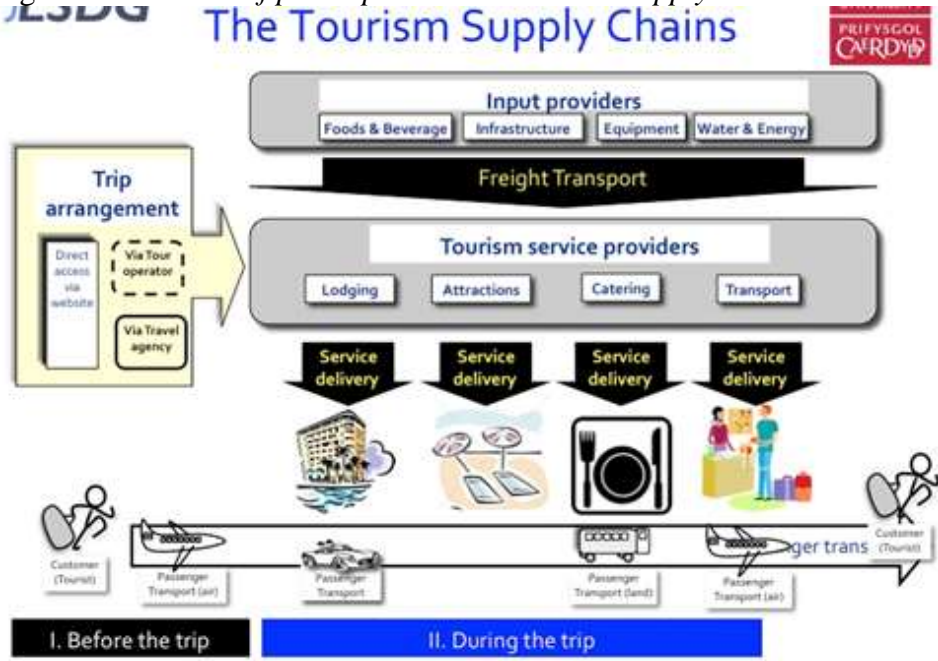
those activities that make a difference in relation to other economic activities. First of all, tourism is an interdisciplinary activity in which different products and services (travel, accommodation, etc.) are connected in order to form the final tourist product. On the other hand, the transit of tourist products is present. Tourist products are simultaneously produced and consumed, which results in the inability to store tourist products and services. In order to consume products of tourism, tourists must travel to destinations where these products are made. Tourist objects and attractions, as well as hospitality industry, represent places of demand and supply, but due to the impossibility of transporting and distributing both material and intangible values from their place of origin to guests, it is necessary for guests to move towards the tourist offer, that is, the distribution takes place in the opposite direction of tourist services. All of these have a significant impact on the complex structure and character of supply chains. Since the tourism product, unlike a manufactured product, cannot be brought to the consumer and the consumer must go to the product, it can be said that tourist complexes and hospitality industry represent the meeting place of two distributions of different directions, i.e. the flow of "distribution" of guests traveling to a tourist destination and the flow of "distribution" of material goods and goods in the system of supplying tourist facilities.

It is necessary to have in mind the complexity of the tourist product, which is global, heterogeneous and represents a blend of various components of services such as: accommodation, transport, sightseeing, shopping, etc. Likewise, the tourism industry faces greater uncertainty and the dynamics of demand, unlike its partners, as a result of the great competition between providers of tourism services. All of these have a major impact on the complex structure and character of supply chains (Figure 1).

Each of the participants in the tourism supply chain has certain goals and interests that are often conflicting with one another. For example, the goal of the supplier is to deliver enormous quantities of goods to a tourist destination in order to maximize profit. On the other hand, the goal of the tourists is the widest scope and variety of tourist services available at a moderate price. The conflict is more pronounced in cases where a supplier can also be a consumer of tourist services. The goal of logistics and supply chain management in tourism is to improve logistics performance, the excellence of business processes and customer satisfaction. This is achieved through the complete integration and

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cooperation of all participants in the creation and consumption of tourist services. The consequences of tourism specificity, as well as the supply chain structure, are critical problems that arise in managing logistics processes in this activity. These problems are observed in practice and are subject to numerous researches in the professional literature, and are analysed in more detail in the next chapter.

Figure 1: *Structure of participants in the tourism supply chain*

Source: *https://pairach.com/tsc/*

Specificity of logistics problems in the tourist region

Each logistical region or destination is characterized by a number of logistical problems which are primarily due to: the great unevenness and seasonal character of demand for tourism products, the limitation of transport and logistics networks, insufficient application of modern information technologies and products management systems and processes in the supply chain.

During the tourist season, the number of inhabitants in the tourist region multiplies with respect to the local population. As a consequence, there are quantitative and qualitative changes in demand for products and services. First of all, there is an increase in demand for consumer goods,

including: groceries, cosmetics, clothing and footwear, sports equipment in accordance with the type of tourist offer, oil derivatives, water, electricity, etc. In addition, demand for services such as catering, hotel services, accommodation, sports and recreation, transport, etc., are also increasing. Production, or the enabling of these services, requires more intensive supply flows, which additionally burden mainly underdeveloped transport capacities. In addition to the quantitative increase in demand, there is a demand for certain products that are not available to the population outside the tourist season. This primarily refers to objects of artistic value, souvenirs, monographs and other tourist publications, as well as to specific products depending on the characteristics of the destination and the tourist offer (Fantazu, et al., 2007).

During the season, there are also quantitative and qualitative changes in transport requirements in the territory of the tourist destination, which affect the volume of business of commercial enterprises, hotels and accommodation facilities, as well as other participants in the formation of a tourist product. For transport companies, there are more and more requirements for the transport of goods and people (Mrnjavac, Ivanović, 2007).

Supply chains are mainly run through different logistic and transport networks, which are made up of transport infrastructure and logistic facilities. Very often transport areas and logistics networks are underdeveloped in tourist areas, and there is no space for capacity building. Coverage of the area of transport infrastructure, as a rule, is determined by the locations of cultural and historical monuments, hotels and other facilities for accommodation, sports, recreational and objects of interest to tourists. For example, in many tourist destinations there is a problem of lack of capacity of road roads, and the construction of additional capacities would negatively affect the appearance, or attractiveness of the destination. This makes it even more difficult to form an adequate transport network and increase capacity during the tourist season at the destination, although minimal investments are required. Various ways are developed to address these problems such as: customized traffic regulations during the season, closing the central city area for passenger cars and offering alternative modes of transport in major tourist destinations that are attractive to tourists (travel trains, tourist buses, etc.), as well as providing the necessary capacity for parking connected with the city centre.

The management of logistic processes and supply chains in tourism can be viewed through two levels. The first one deals with the macro aspect of supply chain management and the optimization of product, people, information, energy, waste and capital flows, which are directed towards the tourist region, destination, or specific geographic area. The management and optimization of logistics operations at this level is directly conditioned by the flow of information and data related to the acquisition, delivery, sale and distribution of material goods and products. The second level relates to logistic services, processes and operations within tourist facilities and between tourist facilities and capabilities within a tourist region or a tourist destination. It is necessary to manage the flows of products and goods that take place in the fittings of individual units and sub-systems of the tourism destination and which have a key influence on the user's satisfaction. The precondition for this is the application of appropriate information technologies and systems that will ensure the visibility of the supply chain and track product traceability through all stages of the chain from the source of raw materials, through production, sales and distribution to tourist facilities (Kaurin, 2017). Primary technology and tools for identifying and monitoring products are key elements for real-time management based on relevant data and facts. Unfortunately, in today's practice, this technology is not sufficiently applied, resulting in a number of problems in the daily supply of tourist regions and destinations. The following is a brief overview of information technologies and solutions that are most commonly used in developed supply chains.

Application of information technology in supply chains

Information Technology (IT) has a very important role in the tourism industry. Modern information technologies enable the presentation and interpretation of tourism products. IT is an effective means of promoting cooperation between stakeholders in the supply chain and improving supply chain efficiency through providing real-time information related to product availability, stock levels, delivery status, and production requirements (Tadić, et al., 2012). They allow suppliers to monitor, manage, and control their flows, products, processes, and activities. Transparency and communication achieved through the application of IT reduces unit operating costs and improves the competitiveness of companies, as well as efficiency, flexibility and cooperation in the entire tourism supply chain. All of the above points to the importance and

necessity of the information technologies application in the management of logistic processes in supply chains in tourism.

The significance of information technologies is even greater if one considers the fact that the application of modern technologies such as e-logistics, electronic distribution and information warehouses can help alleviate and solve numerous problems and difficulties that arise in tourism logistics (Dima, et al., 2014)

Information and communication technologies have a wide range of applications in the tourism supply chain. It is primarily their task to ensure efficient collection and flow of information necessary for the process of management and decision-making, as well as real-time monitoring of products and ensuring the visibility of all processes in the chain and product traceability. In the initial stages of development, the application was limited within the company or within a limited environment, and today, thanks to the Internet, electronic data exchange and powerful telecommunications services and networks, it has assumed global conditions. In general, IT application can be viewed with three significant areas or application problems. The first area is the supply chain visibility, other localization and tracking of shipments, facilities and assets, third-party application solutions and real-time parameter management software (Kaurin &. Kilibarda, 2016)

Visibility of the supply chain

The greatest potential of information technologies is to facilitate collaboration between participants in the supply chain in order to achieve better information visibility and facilitate decision-making. There is a possibility of creating information visibility between suppliers, manufacturers, distributors, tourist organizations and end users. Visibility of information is the process of sharing critical data that is needed to manage the flow of products, services and information in real time between different stakeholders in the supply chain. If information is available but cannot be accessed by participants who need to respond to a particular situation, its value will be reduced exponentially. Increasing information visibility in the supply chain enables revenue growth, resource utilization and cost reduction. In order to increase accountability in supply chains, companies are considering the use of common models that share information at different levels of all participants - from suppliers of their suppliers to customers of their customers (Kaurin &

Kilibarda, 2016). These trading partners need to share forecasts, manage inventory, schedule work, optimize deliveries, and thus reduce costs, increase productivity and create greater value for the end-customer in the chain. Traditional supply chains are rapidly evolving into "dynamic business networks that consist of a group of independent business units that share planning and information execution to meet user requirements.

One of the concepts that are often mentioned lately, which could be applied in the supply chain of tourist destinations, is the concept of the "control tower of the supply chain" (Handfield, 2002; Heaney, 2013). The control tower provides key information available to supply chain partners to facilitate the coordination of customer requirements and supplier response. In order to transform the available data into useful information, development is needed in three areas:

- Processes - Processes should become common, with data exchange and collaboration between departments but also between organizations. Co-ordination of sales projections and supply chains can help suppliers to anticipate future needs. Companies should develop data that can be shared between partners to make it possible to plan demand. Risk management should also be implemented in order to reduce the possibility of supply chain interruption.
- Connection - Information must be shared between processes, different business functions, and outside of the company, providing a realistic insight into processes for all participants. Collaboration is also needed to increase the level of trust between partners.
- Technology - The main challenge in information sharing is the problem of data transfer between different information systems. Innovations such as cloud computing, databases and different software make the control tower possible. Once data are designed to provide participants with all the necessary information, they can later be used for different analysis and planning. The control tower allows companies to manage demand more precisely, in order to reduce inventory levels and respond to customer demands faster and more precisely (Handfield, 2002).

Choosing an adequate solution to improve the visibility of the supply chain requires a complete understanding of what is needed now and in the future in order to outperform competition. The first step in ensuring the visibility, responsibility and control of the supply chain of a tourist destination is to choose the best technology to support this venture. The most important precondition for introducing technology is the ability to

act on the basis of real-time data, which directly relies on the integration of multiple different systems and the ability to monitor data. If any of the two critical components are not available, the solution and also the results will be limited (Heaney, 2013).

Traceability of the product in the supply chain

A significant part of the supply chain refers to the distribution of food products. In order for these products to be safe, with high quality and known geographical origin, it is necessary to provide a traceability monitoring system on the complete supply chain. Traceability as part of logistics management enables food business subsystems to control the process of moving food from the raw material to the final product (Figure 2). Traceability is the ability to track product series and their complete or only partial history, in a production chain from harvesting, through transportation, storage, processing, distribution to sales, or internally in each of the above steps (Bevilacqua, 2015). It is also possible to check the safety and quality of products at all stages of production, distribution and serving and consuming food.

The traceability system should be: verifiable, applicable consistently and impartially, results-oriented, cost-effective, convenient to use, compliant with all applicable regulations or policies and in accordance with well-defined requirements (Bosona, et al., 2013). Of course, this cannot be realized without the use of appropriate information technologies.

Figure 2: *Traceability system in the supply chain*

Source: *http://backtrackerinc.com/*

One of the most well-known systems for traceability in the supply chain is based on Global Standard 1 (GS1) tools (Bechini, et al., 2015). The GS1 system is a set of standards that enable efficient supply chain

management through the unique identification of products, transport units, assets, locations and services, facilitating e-business processes. These standards facilitate national and international communication between all trading partners participating in the supply chain, including suppliers of raw materials, manufacturers, wholesalers and retailers, as well as end users. The system is designed so that it can be used in any industry, commerce or public sector, with no changes being introduced to the system that are harmful to current users who can follow the principles of the GS1 system design applications for automatic processing of GS1 data. This system allows:
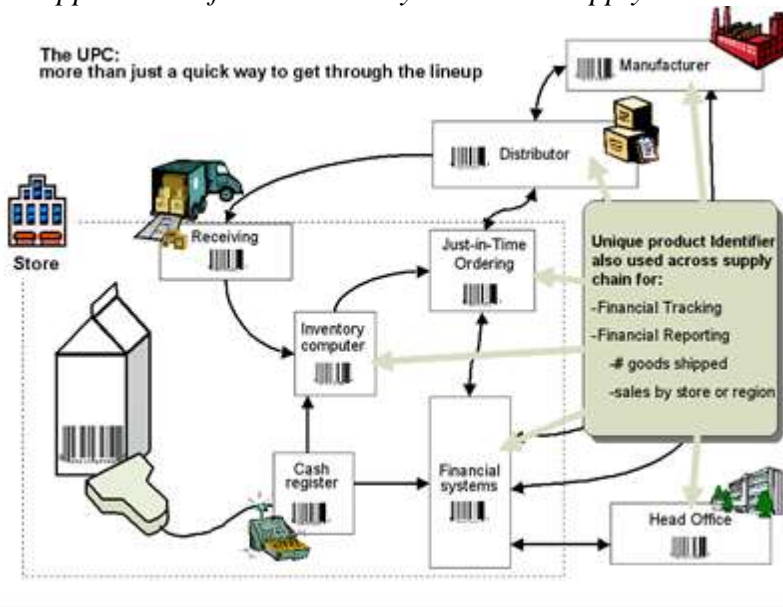
- Unique identification of all products. Any product that we want to track or need to monitor must be uniquely identified. GS1 global unique identifiers are keys that allow access to all available history, application, and product location information. In other words, all traceable units must carry a global, unique identifier directly on the traceable unit. If that is not possible, at least on the packaging or the transferring agent or on the accompanying document.
- Identify the exact location of the product. Unique location identification is provided through GLN (Global Location Number) allocation, for each location and functional entity.
- Identification of trade units GTIN (Global Trade Item Number). In order to identify certain elements, the GTIN is combined with a serial number or batch number (Serial Number or Batch Number) to ensure the complete traceability of the product.
- Identification of the product group. Group traceability is provided through the assignment of a GTIN and a serial number (Lot/Batch Number) to each product (e.g., a consumer unit).
- Identification of the product series. The traceability of the series is ensured by assigning a GTIN and a Serial Number to each product (consumer unit).
- Identification of logistic units (transport packages, pallets). Logistic unit traceability has been provided through the assignment of the GS1 Serial Transport Container Code - SSCC (Serial Shipping Container Code), to each new logistic unit.

In addition, GS1 enables the recording and tracking of all data, managed connections and communication between all participants in the supply chain.

Systems for identifying, locating and monitoring products

Barcode technology has a significant application for automatic identification of goods in different supply chain processes. It is the most common data identification system, and is usually used in warehouse systems, distribution and logistics centres (Figure 3). It is a relatively inexpensive technology that enables automatic identification of data with a high degree of efficiency. The workers once entered the data manually, which took a lot of time. The barcode greatly simplifies the identification, collection, processing and tracking of information, which enables better productivity and time and cost savings. Barcode provides high precision, as well as good data protection. Data cannot be read without an adequate scanner, unless there is a printed field in which the numbers and letters indicate barcode interpretation. The disadvantages are reflected through the constraints related to the rapid reading of a large number of data and the scanning from a greater distance.
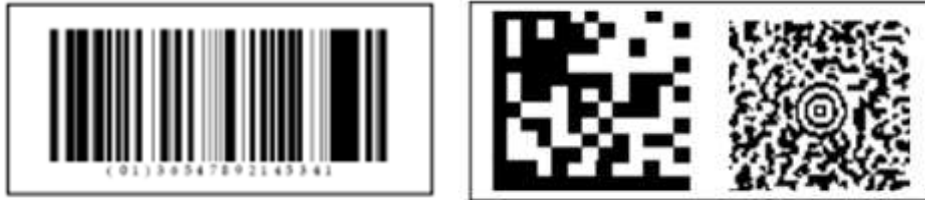
Figure 3: *Application of the barcode system in the supply chain*

Source: *http://www.contentdirections.com/materials*

Basically there are two types of barcodes: linear and 2D barcodes (Figure 4). Linear barcodes are part of everyday life and can be found in supermarkets, bookstores, hospitals, post offices, etc. Linear barcode generally functions as an identification code (ID code) for products.

Figure 4: *Barcode tags*

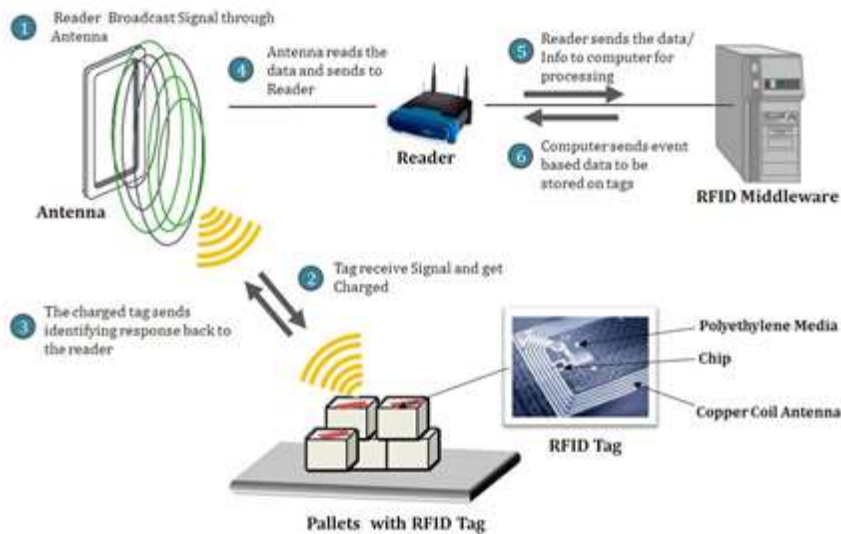|	
a) Linear barcode	*b) 2D barcode*

Source: *https://www.gtin.info/barcode-101/*

The need to process more information in lesser space has led to the development, standardization and growth of the application of 2D bar technology. Where linear barcodes can only perform product identification, this same task can be performed by a 2D barcode by occupying considerably smaller space. Figure 4. shows some examples of 2D barcodes. The 2D barcode can hold up to 2000 characters while the linear barcode will hold much less data up to a maximum of 20 characters. For the same surface occupied by the capacity of the 2D barcode, it goes from 20 to 40 times higher than the linear codes. For this reason, in the traceability concept, 2D barcodes are more suitable for use.

Another important system for product tracking and identification is based on RFID (Radio-frequency identification) technologies. The bases of this system are the tags (radio frequency transponders) which are information carriers and are affixed to products (Figure 5). The second component of this system is readers with an antenna. The RFID device (the reader or information gathering terminal) uses radio waves to send energy to the tag, which then broadcasts feedback. In this information sent by the tag there is a unique identification code or a set of data, which have already been entered in the tag itself. The data thus collected in the reader, as well as in the case of a barcode, can be further processed. The RFID reader transmits the corresponding digital data to the computer in which further processing is performed. The information may contain product location information, and information such as price, color, expiration date, etc. RFID technology ensures greater efficiency, accuracy and visibility (Nikoličić, et al., 2015).

For example, it is possible to place a fixed RFID reader in the warehouse that will control and register the complete entry and exit of goods. Each passage of goods is activated by a reader who reads the goods that are

coming out, or coming in the location. These readers can also be placed on the shelves of the warehouse or the store where the products are exposed, so that every product is taken from the rack or shelf is detected. In the RFID system, a connection must be established between the RFID reader and the computer (or computer system) in which the collected information is stored and updated.

Figure 5: *Application of RFID technology in the supply chain*

Source: *http://newcanaanitect.com*

The Global Positioning System (GPS) is a technology that allows continuous monitoring of products in real time. GPS technology is based on the reception of satellite signals (24 satellites), based on which it is possible to determine the precise position of the device receiving the signals (Figure 6). Today, GPS technology is widespread in various areas and is applied worldwide (Kaurin T., 2016). GPS technology is based on receiving signals from a satellite. Satellite scheduling allows users at any point on the ground to receive signals from at least four satellites. On the basis of satellite data, the GPS receiver determines the exact position of the object (latitude, longitude, altitude) and the exact time Universal Time Coordinated (UTC). There are many examples of the application of GPS technology in different areas, from individual GPS devices that can be used for private purposes, to modern systems for managing different objects and processes. Each application points to a number of advantages of this technology depending on the objectives of the application. The direct benefits of applying GPS technology include: the ability to locate

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real-time locations continuously at any point on the ground, in water and air; use of satellite signals is free of charge; high accuracy of location determination and the possibility of installing GPS receivers in different mobile objects or living beings, etc. The indirect benefits of GPS technology depend on the specific application and realization of the planned goals. In different business systems, indirect benefits can be: more efficient product management, better utilization of business resources, faster response and more efficient deployment of mobile facilities in real time, product traceability, increased security of assets, faces and environments and reduction of environmental pollution, and others. (Fang, et al., 2013).

Figure 6: *Application of GPS system in supply chains*

Source: *http://webcast-inc.com.ph/services/technology-services/*

Conclusion

In the field of logistics and supply chains in tourism it is possible to achieve significant improvements, which will increase the efficiency and cost-effectiveness of the supply of tourist regions or destinations, as well as the quality, and certainly the absolute competitiveness of the tourist offer. An efficient system of supply and service would certainly raise the level of customer satisfaction (Andrejić, et al., 2013). Improvements can be achieved in different areas of logistics and supply chains, and management based on modern information technology is definitely one of

the most important areas. Information technologies and systems provide exceptional opportunities to improve the entire supply system. This paper presents the technologies and solutions that are most often used in different supply chains and are very suitable for use in tourism. In fact, their application is a prerequisite for management and improvement. These technologies allow connecting and informing all participants in a complex supply chain, as well as managing all processes and activities. Suppliers of the supply chain can connect with their business partners and reliably exchange information about products, deliveries, maintain a high level of customer satisfaction and better manage logistics processes (Kilibarda, et al., 2016). Information technology enables real-time visibility of all operations in supply chains and ensures traceability of products through the delivery chain. This is especially important when it is known that dominant products in the supply of a tourist region or destination are food products. Consumers are particularly interested in the quality, safety and origin of these products. In addition, information technology, appropriate platforms and software solutions provide management bases aimed at: ensuring the delivery of the right products at the right place and the right time, in order to achieve high quality of service and user satisfaction, provided that everything is effective and economical. On the other hand, these systems prevent the occurrence of errors such as: delayed or wrong deliveries, expiration of deadlines for the use of products, unnecessary write-off of inventories, large returns of products, etc. After the introduction of new information technologies, conditions are created for the development of information management platforms and the integration of all participants in the supply chain in tourism. This requires a number of software solutions and applications to ensure the full implementation of advanced information and logistics solutions.

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