INFORMATISATION OF TRANSPORT PROCESS USING GPS NAVIGATION SYSTEM

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Abstract

Nowadays, internal business processes are one of the crucial factors of firms' competitive advantage achievement, which is becoming increasingly important, not only on local but also on global markets. Firms' performance improvement depends to a large extent on its flexibility, adjustability and especially ability to manage internal business processes. Hence, use of information technology is among the fundamental elements of business process change, which not only improve competitiveness but also assure long term development and growth of the firm. For all these reasons, the main purpose of this article is firstly to establish that use of information technology is feasible in all industries, explain what possible obstacles for successful informatisation are, and which are major advantages after its implementation. Secondly, within theoretical aspect we present broaden view of informatisation in logistics, whilst practical example illustrates successful informatisation of transport process with adoption of GPS (Global Positioning System) in a transport firm. Furthermore, in this article we are also introducing a case study of three transport firms describing process flow before and after implementation identifying enhanced information quality, service quality and communication as a foremost advantages and achievements after informatisation.

Keywords: Process Change, Global Positioning System, Information Technology, Informatisation.

1 INTRODUCTION

Over the past decade, firms have faced unprecedented change: globalization and internationalisation, rapid advance of information technology (Chan and Peel, 1998), higher value of competition (Atakan and Eker, 2007, Carr, 2002), increased availability and flexibility of products/services (Ahmad and Schroeder, 2001) as well as greater internal and external customer needs (Marjanovic, 2000). Thus, firms can no longer effectively satisfy its customers various demands with just product and price, but must also increase its performance in reaction speed, delivery policy, information services and flexibility. For this reason, firms are in many situations forced to redesign their internal processes, using different methods. As one option among other possibilities, information technology (IT) has been, therefore, recognised as one of the most prevalent facilitator of that process change (Chan and Land, 1999). Furthermore IT not only enables to redesign internal processes but also aids to firms improved competitiveness on local and international markets (Motwani and Kumar, 1998).

Implementation of IT or process informatisation is becoming more and more important also in logistics. Especially due to the ability that adoption of IT improves logistics efficiency, effectiveness and flexibility (Sanders and Premus, 2002). Thus, we can find in logistics many projects where firms implement new advanced technologies such as Global Positioning System (GPS) and other wireless technologies (Shugan, 2004).

Nevertheless, many studies concerning technical aspects of GPS use have been made (Adriansen and Nielsen, 2005, Bodamer, 2001, Stopher, FitzGerald and Xu, 2007) there is a lack of evidence of how implementation of GPS changes internal processes in the firm. Hence, this study sheds light to this

unexplored area by identifying which are the process changes provoked by the adoption of GPS and its impact on internal transport process. In this article we are firstly illustrating literature review of IT payoffs and importance of process informatisation. Secondly we present use of IT in logistics together with presentation of GPS as enabling factor of informatisation. Finally, we are with a case study of three Slovenian transport firms describing how implementation of GPS changes process of transport and which are the most important advantages and process enhancements for the firm.

2 LITERATURE REVIEW

2.1 Information technology payoff and process of informatisation

Definition and role of internal IT can be explained in a several various ways. In the literature it is generally identified as encompassment of all information systems that are only used within the firms boundaries (Ryssel, Ritter and Gemünden, 2004). Use if internal IT has many positive and negative affects on business processes. Therefore, firms need to consider which investment will contribute effectively to their business outcomes/benefits, and determine whether money should be spent in these results (Drinjak, Altmann and Joyce, 2001). We can summarise these benefits in the following categories: (1) productivity; (2) financial variables; (3) efficiency; (4) quality variables; (5) relationship development; (6) customer satisfaction and (7) competitiveness.

Nevertheless, some studies found no positive relationship between IT investments and productivity (Koski, 1999, Strassmann, 1985) examples from Asian countries show some positive results in productivity resulting from IT investments. First study showed enhanced productivity by increase in computer capital stock (Ho and Tam, 2005), while second one explained that those countries with higher growth rates in IT investments achieved consistently higher growth rates of gross domestic product (GDP) and productivity (Kraemer and Dedrick, 1994). In terms of financial variables, Hit and Brynjolfsson (1996) developed that return on assets (ROA) and return on investment (ROI), capital, labor, operating expenses, and revenues have been widely used as variables for investigating IT payoff within organizations. Furthermore, apart from direct financial outcomes firm's profitability has been also recognised as an important outcome of investment in IT (Devaraj and Kohli, 2000). Large impact of IT on firm's internal efficiency has been put forward in many studies in the practical as well as theoretical studies. As an example, Lu (2003) developed that electronic commerce (EC) can help firms to cut costs, interact directly with customers as well as run business smoothly and in an effective manner. Therefore, at the process or function level, EC application is measured in terms of efficient use (Lu, 2003). In addition, IT which enables online communication can enhance firms' efficiency in many ways. It reduces time to reach customers and speeds up responses to customers inquiries (Wu, Mahajan and Balasubramanian, 2003). Furthermore, quality has gained renewed importance as a management concept and is often supported by significant investments in IT. For illustration, high-quality firms are better at controlling costs (Hendricks and Singhal, 1997), thus quality variables are often considered in IT payoff studies (Devaraj and Kohli, 2000, Willcocks and Lester, 1997, Wu, Mahajan and Balasubramanian, 2003). With increased competition and the focus on satisfying customer needs, customer satisfaction is also being researched in IT payoff studies. For example, customer satisfaction has become one of the dominant factors for the success of an EC application (Cho, 1999). In addition, Garrity and Sanders (1998) developed that IT benefits can be also measured at the individual level of analysis through customers' perception of utility and satisfaction. Finally, IT can help firm to outperform its competition (Liu and Arnett, 2000) as well as helps to lower entry barrier to new markets and therefore gaining competitive advantages (Lu, 2003).

In the paragraphs above we presented outcomes of IT investments. Facilitators of these outcomes are changed internal processes due to use of IT, therefore our main focus is process change caused by IT adoption. In the literature many studies in this area can be found. For example, authors developed that use of IT and electronic integration of business processes within the firm can deliver significant

competitive advantages and cost savings (Krishnan, Ramaswamy, Meyer and Damien, 1999). Furthermore, successful deployment of IT assets leads to IT impacts such as redesigned processes, improved decision making, and improved coordination (Forgionne and Kohli, 1996, Kohli and Piontek, 2008). Moreover, the process view of IT investments was also explored by Mooney, Gurbaxani and Kraemer (1996) in their framework proposing that firms derive business value from intermediate operational and management processes. They suggest, that constant presence of IT in the firm reflects in greater impact on the processes and eventually on the firm. This dramatic change of internal processes is known as process redesign or process informatisation. Informatisation of business processes can derive many advantages for the firm, therefore it is essential for firms to know that in the context of technology investments and organizational practices (such as process change), the two together may also affect performance significantly (Devaraj and Kohli, 2000).

According to the findings from the literature, the importance of information technology in process change is significant. IT investments and process informatisation cannot succeed in isolation (Barua and Lee, 1997). Recently, IT exploitation has been increased especially in logistics; therefore, in continuation of this article we are describing the importance of process informatisation in logistics.

2.2 Informatisation in logistics

Logistics has been, in an industrial context, defined as the art and science of obtaining, producing, and distributing material and product in the proper place and in proper quantities (Lummus, Krumwiede and Vokurka, 2001). Many firms began to employ the logistics concept during the 1970s. This was during this time that firms began to integrate the traditional business functions of traffic management, warehousing, inventory control, and in some cases purchasing, into a single organizational function (Kent Jr, 1996).

While many factors have increased the burden on the logistics system over the last decade, we can also identify one factor which has had great positive influence on the operation of the logistics system - the development and implementation of powerful and inexpensive IT (La Londe and Masters, 1994). IT has been evolving within the logistics function for decades (Kent Jr, 1996), and nowadays its adoption and successful implementation is a prerequisite for logistics success (Wang, Lai and Zhao, 2008). Because IT offers a great opportunity to improve logistics efficiency, effectiveness, and flexibility, an increasing number of firms have turned to IT to achieve a significant competitive advantage (Ives and Jarvenpaa, 1991, Sanders and Premus, 2002). Bowersox and Closs (1996) also developed that IT is one of the few productivity tools that can increase capability, reduce costs, and improve service simultaneously; similarly, Sanders and Premus (2002) report that IT may reduce cost, improve productivity, and so forth.

The most broadened use of IT in logistics are information systems that include suites of computerized applications which are referred to as an logistics information system (LIS) (Wolfe, 1990). Contemporary, LIS applications include: demand forecasting, inventory planning, distribution resource planning, master production scheduling, materials planning, capacity planning, order processing, transportation analysis, transportation routing, tracking/tracing, invoicing, rating and electronic data interchange (EDI) (Wolfe, 1990). Use of IT in logistics is not important only for internal benefits but also for strengthen the relationships among all stakeholders in the logistics process. Hence, the information systems in logistics are oriented towards technology and communication enhancements as well as fulfilling all legal stakeholders demands (Konsynski, 1993). These systems were created with the purpose to enable to process required data as well as efficient communication among all interested parties (Christiaanse and Kumar, 2000). They usually integrate direct electronic connections between suppliers and customers, or systems for electronic data interchange such as processing orders, preparing invoices and other documentation (Min and Galle, 1999).

Due to the fact that use of IT is unavoidable we can often find its use also in ports as well as in international transportation and logistics services. For example, in the Australian maritime industry,

terminal operators and port/transport industry developed a longer-term approach to EC to improve the efficiency of operations, aiming to enhance the competence of their existing operational system (Kia, Shayan and Ghotb, 2000). Furthermore, a properly-designed, computerised container control system increases the operating efficiency of the terminal (Kia, Shayan and Ghotb, 2000). Another example is held in America where one of their transport firms has put in place a system to transfer dispatch, fuel purchase and GPS tracking data to IT via the Internet. The system provides a unique, trip-based process, where GPS points for each trip are matched to the respective dispatch records; an out-of-route analysis tool, in which the "practical" versus "actual" miles are analyzed to identify trips that are out-of-route; reports and mapping tools, which help the fleet identify and analyze each trip. As a result of this data, the firm is able to produce maps of the worst trips for distribution to driver-managers and to drivers. The process has helped reduce costly out-of-route travel (Klein, 2004). According to this we can conclude that GPS has a significant impact in logistics. Thus, our research interest is to explore of how adoption of GPS changes transport process and which are the main advantages for transport firm. Moreover, freight carriers in order to optimise urban distribution, redesign their processes in such a way so as to minimize their operational costs (number of vehicles in use and total distance travelled during delivery execution) (Davenport and Brooks, 2004, Tarn, Razi, Wen and Jr, 2003). They integrate wireless communication systems such as General Packet Radio Services (GPRS) (Giaglis, Kourouthanassis and Tsamakos, 2002) in conjunction with satellite constellations such as Global Positioning System (GPS) (Djuknic and Richton, 2001) with current vehicle routing systems (VRS) (Gayialis and Tatsiopoulos, 2004, Matsatsinis, 2004), and geographic information systems (GIS) (Keenan, 1998) to provide mobile-enabled real-time distribution management services. These services are designed for collection of real-time information such as position of the vehicles, proof of delivery (POD), and field alerts (for example, temperature violations in frozen cargo); and re-routing of vehicles when the execution of delivery cannot follow the pre-assigned plan, due to some unforeseen event (Zeimpekis and Giaglis, 2006).

Consistent with previous findings we can sum up that use of IT in logistics brings many advantages for the firm, hence nowadays more and more firms decide to redesign internal processes using IT (Sanders and Premus, 2002). Concentrating mainly on transport firms, GPS is the most preferable used LIS (Zeimpekis and Giaglis, 2006), which reduces the cost of communication (Cantor and Macdonald, 2008), improve service planning, inventory management, distribution and safety of management decisions (Sanders, 2007). Consequently, GPS enables more market-oriented firms (Cantor and Macdonald, 2008) and impacts its competitive position on the market (Sambamurthy, Bharadwaj and Grover, 2003). Based on these factors we are in the following paragraphs describing how transport process changes using GPS and which the main benefits for the transport firm are.

2.3 Informatisation of transport process with Global Positioning System

Today, GPS-based navigation systems can be found in motor vehicles, farming and mining equipment, and a variety of other land-based vehicles (e.g., golf carts and mobile robots) (Abbott, Powell, Signal and Redmond, 1999). While it is globally available and free-of-charge (Zeimpekis and Giaglis, 2006) GPS appears to be the most preferable solution and thus frequently forms part of existing vehicle infrastructure for many firms (Zeimpekis and Giaglis, 2006). For that reason, GPS is becoming more and more broadened use of IT in transport industry (See, 2007).

Shortly, GPS is a satellite-based navigation and time transfer system developed by the U.S. Department of Defence. It serves marine, airborne, and terrestrial users, both military and civilian. Specifically, GPS includes the Standard Positioning Service (SPS) which provides civilian users with 100 meter accuracy, and it serves military users with the Precise Positioning Service (PPS) providing 20-m accuracy. Both of these services are available worldwide with no requirement for a local reference station. In contrast, differential operation of GPS makes available 2- to 10-m accuracy to users within 1000 km of a fixed GPS reference receiver (Enge, 1994). Furthermore, GPS is an essentially passive mechanism, in that it does not involve any intrinsic disclosure by the GPS receiver

to any other device. It can, however, be combined with transmitters and transponders to produce devices that disclose location to another party (Clarke, 2001).

Primarily designed as a land, marine, and aviation navigation system, GPS applications have expanded to include surveying, space navigation, automatic vehicle monitoring, emergency services dispatching, mapping, and geographic information system georeferencing (Dana, 1997). Because the dissemination of precise time is an integral part of GPS, a large community of precise time, time interval, and frequency standard users has come to depend on GPS as a primary source of control (Dana, 1997). Moreover, mobile geographic information systems integrating GPS with hand-held computers and special software make appropriate information available to personnel working with it (Connolly, 2007). For example, fire-fighters can use it to find the nearest fire hydrant, and park rangers can access the appropriate map and record changes in the natural habitat whilst they are in the field (Connolly, 2007). In addition, the GPS equipment captures data that could not be obtained using traditional methods, such as travel speed and specific routes or paths taken by the driver. These information are necessary for transportation planners to make analysis of GPS-recorded travel (Murakami and Wagner, 1999).

GPS navigation system enables users several alternatives of use. For instance, handwriting devices, voice recognition devices, and GPS systems enable users (especially disabled and elderly people) to input their location parameter in a convenient way in different situations. What is more, with the help of eye-tracking devices, such systems could benefit those with disabilities since they help automatically choose a target device from a device set (Hong, Chiu, Shen, Cheung and Kafeza, 2007). In addition, GPS receivers provide a fast and convenient method for obtaining position information that can be collected in real time (Taylor, Woolley and Zito, 2000). Authors, furthermore, also explain the use of GPS in traffic studies and the theory of and methods for instantaneous speed observation using GPS. They also describe a series of experiments which validated the above results for both position (Quiroga and Bullock, 1998, Zito, D'Este and Taylor, 1995). In transportation GPS technologies provides for transportation engineers collection of data such as vehicle trajectory, travel time and travel speed (Jiang and Li, 2002).

Use of GPS brings many benefits for traffic planning, like; vehicles equipped with a GPS device provide speed data to the Traffic Management Centre, which in turn disseminates congestion information and forecasts to wireless information service providers (Thill, 2000). Likewise, improved efficiency of traffic data collected and the safety of operators are enhancements for the firm, due to use of GPS (Li and Qin Zhu, 2003). Adding together, adaption of appropriate information and mobile communication technologies like GPS into logistic fleet management, can effectively improve the fleet resource utilization and customer satisfaction (See, 2007). Moreover, modern logistic system requires real-time monitoring and interaction with fleet vehicles to attain high fleet operation and provide fast response to customer's need (See, 2007).

According to the literature we can conclude that firms which informatise transport process using GPS should gain many advantages such as improved quality of information and process efficiency. Therefore, the main purpose of this article is to investigate in transport firms what the process changes and foremost advantages after implementation of GPS are.

3 RESEARCH METHODOLOGY

To achieve the main objectives of this research, an exploratory multiple case study method was adopted. Generally, case study is a research method which focuses on understanding the dynamics present within single settings (Eisenhardt, 1989). According to Yin (2003) exploratory case study can answer exploratory, descriptive or analytic research questions. Therefore, it can explain, describe, illustrate, explore or evaluate the studied social phenomenon without prior definition of research questions and hypotheses. Case studies involve either single or multiple cases and numerous levels of analysis (Yin, 1984). Multiple cases within each category allows findings to be replicated within

category (Huberman and Miles, 2002), generalizing the models (Gersick, 1988), establishing theories (Pettigrew, 1990) and expending initial frameworks (Eisenhardt and Bourgeois, 1988).

We consider this study to be exploratory for three reasons. First, exploratory research methodology is used when not much is known about the situation at hand (Collis and Hussey, 2003). Second, exploratory research is useful in clarifying issues surrounding a phenomenon, to gain an understanding, to help in analyzing and in problem definition (Zikmund, 1988). Third, exploratory research is appropriate in a topic which has no established theoretical base or methodology (Creswell, 1994). For all these reasons exploratory research methodology is the most appropriate and therefore enables to explore and understand how implementation of GPS changes transport process and which are the main benefits for the firm. Furthermore, it allows application of more than one data collection methods which consequently strengthen the research findings. Finally it involves more than one participant in the study and therefore assures validity, reliability and replicability.

3.1 Data sources

Research was carried out with use of qualitative methods from multiple resources (Eisenhardt, 1989). To assure well grounded and solid findings (Eisenhardt and Bourgeois, 1988, Yin, 1984) data were collected by three different resources: (1) semi-structured interviews with 10 employee in three different transport firms and 10 firms customers, (2) archival materials from firms archive; and (3) observation.

3.2 Method of analysis

All semi-structured interviews were taped and later transcribed for further analysis. Content analysis was the method to gather data for this study. In logistics content analysis is a method for the objective, systematic, quantitative and reliable study of published information (Ellinger, Lynch, Andzulis and Smith, 2003), a suitable method for comprehensive literature reviews (Pasukeviciute and Roe, 2005), instrument for determining key ideas and themes in publications (Cullinane and Toy, 2000) but also for measuring comparative positions and trends in reporting (Kent and Flint, 1997).

Generally, researchers are aware of an element of subjectivity in content analysis because it requires the classification of information by judges (Peterson, 1998). A certain degree of judgment is required when this method of acquiring insights is brought into play. Nevertheless, if the technique is applied systematically and with proper controls, such as definite explorations of the variables to be analyzed, it can yield appropriate levels of validity and reliability (Kolbe and Burnett, 1991).

Content analysis builds on a coding scheme that is developed on the basis of a theoretical framework (Guthrie, Petty, Yongvanich and Ricceri, 2004). In order to derive patterns in the presentation and reporting of information, content analysis we developed coding scheme of qualitative (Arlbjørn and Halldorsson, 2002) and quantitative information into pre-defined categories (Pasukeviciute and Roe, 2005). As for the quantitative measure in content analysis, we used frequency which indicates the importance of the subject matter (Guthrie, Petty, Yongvanich and Ricceri, 2004).We did not use data for any further statistical analysis.

4 RESEARCH FINDINGS

4.1 Transport process before implementation of GPS

Before the implementation of GPS transport process was not properly supported by information technology. Monitoring and realisation of the process as well as documentation handling was mainly paper based, therefore transport organisers spent to a large extent of needless time. Driver and other employees in the firm (transport organiser, administrator) communicated using cell phone or fax. For

this reason this form of communicating was very costly and long-lasting. Moreover, transport organiser did not have full control over the position of the vehicle, expected pick up and delivery time. Regards the fact that transport organiser did not have up to date information about the transport service he/she could not interpose these information to the customer. Further planning of transports was hence hardened. Detailed process flow of transport process before the implementation of GPS in presented in the following table 1.

Activity nr.	Name of activity	Input	Output	Method used
1	Receiving an order	Order	Internal order	Phone, e-mail, post
2	Sending information to the driver	Internal order	Information interfered	Text message, telefax
3	Delivery of the vehicle	Information interfered	Delivered vehicle	Text message, telefax
4	Loading	Delivered vehicle	Loaded vehicle	/
5	Control of loading	Loaded vehicle	CMR, delivery note	Written documentation
6	Transporting	CMR, delivery note	CMR, delivery note	Written documentation
7	Delivery of the vehicle	CMR, delivery note	Delivered vehicle	Written documentation
8	Unloading	Delivered vehicle	Confirmed CMR, delivery note	Written documentation
9	Control of unloading	Confirmed CMR, delivery note	Travelling order	Written documentation
10	Archiving of documents	Order, travelling order, CMR,…	Archived documentation	Written documentation

Table 1: Process flow of transport process before implementation of GPS

According to the current process flow interviewees indentified the following defectiveness of the transport process: (1) incomplete and inexact information about number of hours covered; (2) not up to date information about the location of the vehicle; (3) incapability to intervene the latest right information about transport service to the customer; (4) inappropriate archiving of the data and documents; (5) complicated procedure when preparing and analysing documents; (6) hardened planning of current and future transports; (7) poor quality of information. For all these reasons transport firms decided to implement GPS to in general enhance transport service. IT supported process is described in the next table 2.

4.2 Transport process after implementation of GPS

According to the process flow in the upper table we can conclude that has implementation of GPS drastically changed transport process: written documentation was replaced by electronic data handling and communication was transformed from using cell phones and faxes to use of GPS devices. Furthermore transport organisers has up to date information about the location of the vehicle, which consequently enabled them to enhance transport planning for further transport to assure increased efficiency and productivity of the vehicle. Shortly we can list the next advantages of use of GPS: (1) ability for constant tracking the location of the vehicle, (2) recording the working and resting time of the driver, (3) faster and simple communication between the driver and transport organiser as well as among all drivers that are in the system, (4) faster realisation of transport process, (5) simple electronic archiving of the documents and other information, (6) enhanced transparency, punctuality and correctness of the information. All this findings was also confirmed by data gathered through semi-structured interviews that are illustrated in the following paragraph.

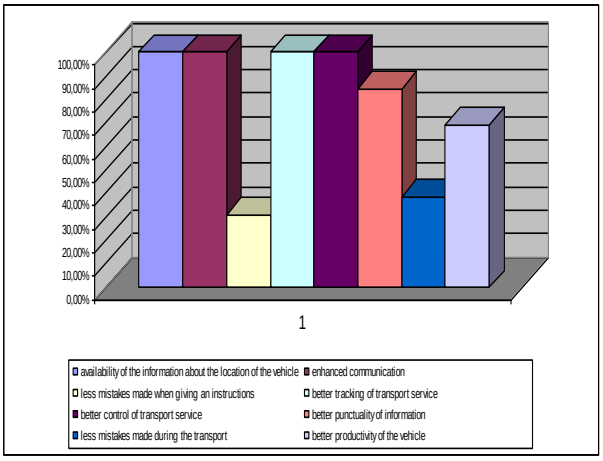
Activity nr.	Name of activity	Input	Output	Method used
1	Receiving an order	Order	Internal order	Phone, e-mail, post
2	Sending information to the driver **using GPS**	Internal order	Information interfered	**Text message sent using GPS**
3	Delivery of the vehicle	Information interfered	Delivered vehicle	**Constant control using GPS**
4	Loading	Delivered vehicle	Loaded vehicle	**Constant control and text message sent using GPS**
5	Control of loading **using GPS**	Loaded vehicle	CMR, delivery note	Written documentation **Constant control using GPS**
6	Transporting	CMR, delivery note	CMR, delivery note	Written documentation **Constant control using GPS**
7	Delivery of the vehicle	CMR, delivery note	Delivered vehicle	Written documentation **Constant control using GPS**
8	Unloading	Delivered vehicle	Confirmed CMR, delivery note	**Constant control and text message sent using GPS**
9	Control of unloading **using GPS**	Confirmed CMR, delivery note	Travelling order	Written documentation **Constant control using GPS**
10	Archiving of documents	Order, travelling order, CMR,…	Archived documentation	Written documentation **Archival data in GPS**

Table 2: Process flow of transport process after implementation of GPS

4.3 Factors of informatisation of transport process using GPS

According to the literature use of GPS enables for transport firms to reduce costs of communication, enhance information quality throughout availability to share the information (Cantor and Macdonald, 2008). Additionally GPS improve service planning and develop increased productivity because of better safety of management decisions (Sanders, 2007). Thus, GPS is becoming the most preferable (Zeimpekis and Giaglis, 2006) and widely used information system in logistics especially transport industry (Abbott, Powell, Signal and Redmond, 1999).

In compliance with the literature findings we can also conclude that implementation of GPS has an enormous impact not only on transport process but also on firms' performance. Looking closely to the process changes from the firms' as well as customers perspective of all interviewees we can bring to a close that majority of theoretical grounds are coherent with research findings. Hence, all interview candidates agree that GPS enables constant availability of the information about the location of the vehicle; enhanced communication likewise better tracking and control of transport service (see also Table 3 and Graph 1). Nevertheless, better punctuality of information and better productivity of the vehicle did not reach 90% of level of agreement from interviewees we terminate that GPS also in these two factors has significant effect on transport process. However, we can not support the fact that firms would made less mistakes when giving and instructions (level of agreement 30.76%) and during the transport service realisation (level of agreement 38.46%).

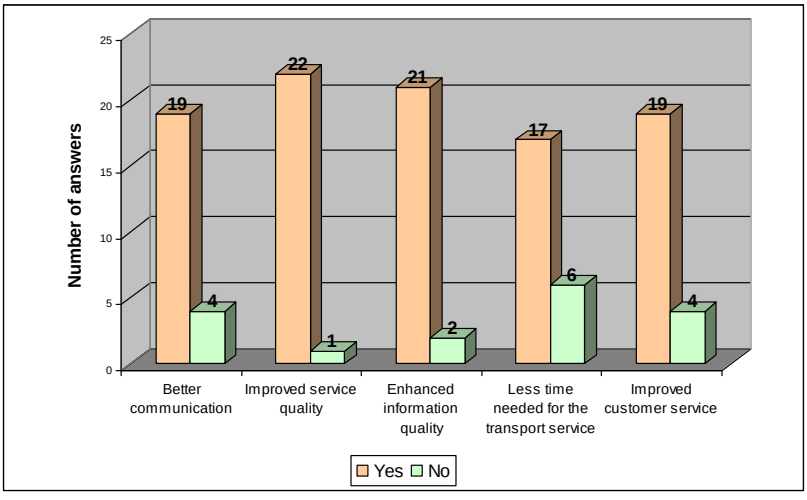


Graph 1: Advantages of use of GPS

Affect of use of GPS on transport process	% of agreement
constant availability of the information about the location of the vehicle	100,00%
enhanced communication	100,00%
less mistakes made when giving an instructions	30,76%
Better tracking of transport service	100,00%
Better control of transport service	100,00%
Better punctuality of information	84,61%
less mistakes made during the transport	38,46%
Better productivity of the vehicle	69,23%

Table 3: Advantages of use of GPS

As already explained above that implementation of GPS changes mainly method of communication (drivers do not communicate using cell phones and faxes any more) and completion of transport service, style of preparing and handling the information for both parties (driver and transport organiser or other employee in the firm) as well as delivery times and relations towards customer. To support these conclusions we furthermore questioned all interviewees what is their level of agreement with our suggestions (see also Graph 2). According our previous discoveries they confirmed that adoption of GPS in transport firm through process change provokes firstly improved service quality (level of agreement 95.65%), secondly enhanced information quality (level of agreement 91.30%) and finally better communication in addition to improved customer service (level of agreement 82.61%). On the other hand, less time needed for the transport service did not receive that strong support whereas over 26% of respondents disagree that this depends on GPS implementation benefits. They explained that time needed for transport service depends largely on traffic situation on the road, kilometres coved and legal road regulations in the country where transport service is made.



Graph 2: Level of agreement of process changes in numbers of answers

Notwithstanding, the importance of informatisation of transport process using GPS, we can not neglect the supporting issues need to be accomplish for successful conclusion of the project. Found in the literature we can summarise that management support, the importance of the project, good relations between the developers of the software for GPS and GPS users, direct interaction of users of the

system, resources needed, established communication and finally positive work environment (Kent and Mentzer, 2003) are concerns needed to be discussed to avoid jeopardising of project failure.

5 DISCUSSION

Information technology has been among the foremost topics not only within the logistics literature but also in other literatures of recent years. Process change using information technology or informatisation apart from changed processes (Attaran, 2003) also brings many benefits for the firm (Bowersox and Daugherty, 1995).

When informatising business processes firms use numerous diverse forms of IT, like enterprise resource planning (ERP) systems, electronic data interchange EDI or other information systems (Patterson, Grimm and Corsi, 2004), especially in logistics called logistics information systems or LIS (Wolfe, 1990). Therefore, in this article we researched how implementation of Global Positioning System (GPS) as one form of information system used in logistics changes transport process and what are the main benefits of this change for the transport firm. Research was made in three Slovenian transport firms which make transport service in Slovenia as well as Europe for domestic and European customers. Therefore, all firms are facing hard competition, constantly changing customer needs and legal regulations in these countries. Consequently, they are forced to adjust to this changing working environment and for all these reasons many companies decide to implement one of the most frequent used information system – GPS (Abbott, Powell, Signal and Redmond, 1999) which enables the firm constant tracking of the vehicle.

According to the research findings one of the most important enhancement of transport process after implementation of GPS is constant availability of the information about the location of the vehicle, improved communication, better tracking and control of transport service. All these benefits, therefore outputs better communication skills of the firm, improved service and information quality in addition to enriched customer service. However, not all changes could be marked as very beneficial. Interviewees did not agree that GPS adoption would enable firm to make less mistakes when giving an instructions and making the transport service. Furthermore, research findings can also not fully support the fact that firm would need after informatisation less time to make transport service. For clarification, respondents illustrated that this is mainly due to other issues on and off the road.

6 CONCLUSION

In this study we investigated a process change of internal processes after execution of GPS navigation system, which enables transport organiser continuous tracking of the vehicle through satellite signal. Research was carried out in Slovenian transport firms that have already introduces GPS as a leading IT tool supporting transport process. Although, research was limited to only three transport firms and to small market, results confirmed that after adoption of GPS transport firm not only improves information and service quality but also enhances communication flows as well as customer service. Research is significant for better understanding the importance of IT use in transportation. GPS includes increasingly important technological progressed device, which allows transport firms' continuous tracking of the vehicle. Hence, firms' transport process changes severely and question of how these benefits affect firms' performance should be our future concern. In the previous researches it has been put forward may times that use of IT has a large impact on firms' performance (Devaraj and Kohli, 2000, Dewan and Min, 1997, Hitt and Brynjolfsson, 1996, Kraemer and Dedrick, 1994). Nonetheless, there is a lack of empirical results of how GPS as a form of use of information technology effect firms performance including financial variables, customer satisfaction, competitiveness, etc. Thus, we suggest orienting towards these issues in further studies in logistics.

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