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THE PRACTICAL ASPECTS OF LOCAL DEVELOPMENT OF ENTREPRENEURSHIP AND INNOVATION IN TRAVEL COMPANIES

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Abstract: The aim of this publication is to present the effects of one of the projects conducted in Opole Province, titled "The effective transfer of knowledge from science to industry in Opole Province" and its impact on the practical aspects of the local development of entrepreneurship and innovation in travel companies. The presented material constitutes an attempt to answer the research problems associated with the introduced innovations. These problems have been formulated as the following questions: Is the GPS functional enough to significantly improve transportation services? Does the cost of implementing the system not exceed the profits it generates? Does the use of GPS in performing transportation services cost-effective also for small businesses? Is a company that uses the GPS able to meet the increasing customer expectations? How can a business benefit as a result of implementing the system? To verify this objective, theoretical research tools were used, such as: analysis, synthesis, generalizations, and comparisons. In terms of practical methods, the following found application: observation method (gathering information on companies, interviews with employees, analysis of documents) and analytical method.

Keywords: development of entrepreneurship (business development), innovations, research projects, Oslo Manual, tourism.

1 Introduction

The publication describes the scope of process and organizational innovations introduced in travel companies. It examines the extent of organizational and process innovations with respect to the provision of services. It also describes the goals of transportation and one of the innovative solutions used in the surveyed companies. From the group of 200 companies in which the innovations were implemented – as part of the project *The effective transfer of knowledge from science to industry in Opole Province* conducted within "Priority VIII Regional human resources, Measures 8.2 Transfer of knowledge, Submeasures 8.2.1 Support for cooperation between science and business" of the Human Capital Operational Programme, and co-funded by the European Union through the European Social Fund, two companies, namely *Eurotramping* and *Opawy*, were chosen.

The presented material constitutes an attempt to answer the research problems associated with the introduced innovations. These problems have been formulated as the following questions: Is the GPS functional enough to significantly improve transportation services? Does the cost of implementing the system not exceed the profits it generates? Does the use of GPS in performing transportation services is cost-effective also for small businesses? Is a company that uses the GPS able to meet the increasing customer expectations? How can a business benefit as a result of implementing the system?

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2 The idea behind the project *The effective transfer of knowledge from science to industry in Opole Province*

The project *The effective transfer of knowledge from science to industry Opole Province* was initiated in 2014 under the guidance of Opole Province's Marshal Office. The partners of the project included the Opole University of Technology and Opole University, with the international partnership of the University of Mannheim. The project consisted of three stages. At the first stage, 20 employees and 100 companies per university were selected among the higher educational institutions of Opole. Simultaneously, the University of Mannheim conducted an analysis of the regional system of innovation and knowledge transfer in Opole Province, and examined the cases of best practices of the systems of knowledge and innovation transfer that have proven internationally successful. During the second stage of the project, the selected university employees collaborated with the companies to put forward the proposals of innovative solutions. The third stage marked completion of the project and comprised evaluation of the collected data and generation of final reports, along with the summary report (Ruffer, et al., 2015, pp.18-19).

3 The scope of innovation in travel companies

The aim of reorganization of transportation services and improvement of their safety in travel companies is primarily served by process and organizational innovations. The process innovations, otherwise known as technological innovations, are defined in the Oslo Manual as innovations within the process. They relate to the implementation of a new or significantly improved method of production or provision (Oslo Manual, 2008, p.51). This category includes important changes relating to technology, hardware and/or software. It may also involve changing the organization of production methods, as well as the ways in which a given product reaches the consumers.

These methods may entail introducing changes to the hardware or to the organization of production; they may also combine these two types of changes, or be the result of the use of new knowledge. They may aim to produce or provide new or improved products that could not be otherwise produced or provided using conventional methods. Finally, these methods may also strive to increase the efficiency of production or provision of existing products (http://www.rsi.org.pl/index.php/pl/I--31, 27.html: 05/04/2015).

Innovations within processes can have the objective of reducing unit costs of production or provision, improving quality, producing or providing new or significantly improved products (Oslo Manual, 2008, p.51).

Delivery methods concern company logistics and include hardware, software and techniques used to acquire the means of production, allocation of resources within the company or delivery of end products. An example of a new delivery method is the introduction of the system for controlling the movement of goods, based on barcodes or RFID (radio-frequency identification of goods).

Process innovations include new or significantly improved methods for the creation and provision of services. They can rely on significant changes in the hardware and software used in service companies or on the procedures or techniques used to provide services. Examples include: introducing GPS-based tracking devices in transportation services, implementing a new reservation system in a travel agency, or devising new techniques of project manage-ment in a consulting firm. Process innovations also cover new or significantly improved techniques, hardware and software in ancillary activities such as procurement, accounting, IT support and maintenance works (Kucińska-Landwójtowicz, 2013, pp.181-189).

Implementation of new or significantly improved information and communication technologies constitutes an innovation within the process as long as its goal is to increase the efficiency and/or quality of an ancillary activity (Oslo Manual, 2008, pp.51-52).

Organizational innovation is interpreted in the Oslo Manual as the implementation of a new organizational method in business practices adopted by the company, in workplace organization or in external relations. Their goal may be to achieve better results by reducing administrative costs or transaction costs, raising the level of job satisfaction (and thus labor productivity), gaining access to assets that are not subject to trade (such as non-codified external knowledge) or reducing costs of delivery (Oslo Manual, 2008, p.53).

A distinguishing feature of organizational innovation, as compared to other organizational changes within the company, is the use of such organizational method (in the adopted business practices, in workplace organization or in external relations) that has yet to be used in the company and that stems from strategic decisions made by its management. Organizational innovations in business practices involve implementing new methods of organization of routine activities and procedures governing the work of the company. This includes, for example, implementation of new practical rules for better learning and knowledge-sharing within the company. This may be exemplified by first implementation of practical rules for knowledge codification, e.g. a database of best practices, lessons learnt and other types of knowledge so that others can have easy access to the database. Another example is first implementation of practical rules for the development of employees and improvement of staff's retention index, e.g. through education and training systems. Yet another example would be first introduction of the systems managing the process of production or delivery, e.g. supply chain management, as well as a thorough transformation of business processes, or systems of "lean" production and quality management systems (Oslo Manual, 2008, p.53).

Innovations in workplace organization involve implementing new methods of task distribution and decision-making among employees to make the division of labor within departments and between departments (and organizational units). This type of innovation also comprises the implementation of new concepts for the structuring of activities, such as integration of different types of company activities. An example of organizational innovation in the field of workplace organization is, first, implementation of an organizational model that offers employees more autonomy in decision-making and encourages them to communicate their ideas. This can be achieved through decentralization of group activity and management control, or establishment of formal or informal working groups within which the responsibilities of individual employees will be defined more flexibly. Organizational innovations may also involve the centralization of activity and increase of responsibility for making decisions. An example of organizational innovation in the field of structuring company activity is, e.g., fist-time introduction of on-demand production systems. Another example is integration of sales and production, or integration of construction-and-development works with production (Oslo Manual, 2008, p.54).

New organizational methods in the field of external relations involve the implementation of new ways of organizing relations with other companies or public institutions, such as establishment of a new type of cooperation with research institutes or with customers, new methods of integration with suppliers, as well as first outsourcing or subcontracting the elements of activity such as production, supply, distribution, recruiting and ancillary services. Organizational innovations are not those changes introduced in the adopted business practices, workplace organization or external relations that are based on organizational methods used by the company on a previous occasion (Szewczyk, et al., 2011 pp.41-48). Neither is innovation a mere formulation of a management strategy. On the other hand, the organizational changes implemented in response to a new management strategy constitute an innovation as long as this is the first time this new organizational method has been implemented in the field of business practices, workplace organization or external relations. For instance, introduction of a written strategic document to be used as a way to improve the efficiency of the use of knowledge in the company is not an innovation *per se*. Innovation, meanwhile, occurs when this strategy is implemented through the use of new software or rules of information documentation in order to stimulate the exchange of knowledge between different departments of the company. Merging with other companies and business acquisitions are not considered organizational innovations, even if the company merges or makes an acquisition for the first time. Mergers and acquisitions, however, may involve organizational innovations if the company decides to develop or introduce new methods of organization as part of the process (Oslo Manual, 2008, pp.

54-55). In terms of the reorganization of services and improvement of their safety in travel companies, the provisions of the Oslo Manual on innovation in the services sector also apply.

The importance of innovation in the services sector and the contribution of this sector to economic growth has been enjoying increasing recognition, which consequently prompted a series of research studies conducted on innovation in services (de Jong, *et al.,* 2003; Hauknes, 1998; Howells, et al., 2004; Miles, 2005). The services sector is diverse, and Howells and Tether distinguish four groups of services: services relating primarily to products/goods (e.g. transportation and logistics), services relating to information (e.g. telephone customer service centers, known simply as *call centers*), knowledge-based services, and services concerning people (e.g. healthcare) (Howells, et al., 2004). Although this diversity should be taken into account, there are general features which are relevant to most services, the key of them being that the distinction between products and processes is often imprecise due to the fact that production and consumption occur simultaneously. In the case of services, the creation of processes may be less formalized than in the case of products, where the initial phase consists of searching, collecting ideas, and assessing their commercial value, and is done the implementation phase.

Furthermore, innovation-related activity in the services sector often resembles a continuous process and comprises a series of incremental changes within products and processes. This can sometimes hinder recognition of innovation in the services sector in terms of individual events, i.e. implementation of a significant change in products, processes or other methods. (Oslo Manual, 2008, p.40).

4 The objectives of transportation and its importance to the national economy

Transportation is an activity that involves movement, by means of transport, of various kinds of freight and persons. It is the part of the world economy and it determines its sustainable growth. It plays a crucial role in it because it accompanies every economic and social activity, rendering it essential for the proper functioning of an efficient economic system.

When choosing a specific carrier, required to physically move entrusted freight, persons or goods, one usually considers things such as: economic conditions of the service, shipping time, technical conditions of transportation, punctuality and reliability of delivery, safety of transported freight, service comprehensiveness, flexibility of the carrier in case of order changes.

Transportation is vital to the economy as it cannot be replaced by other activities or processes. There is no substitute for this activity, and therefore the relationship between transportation and economy is that of feedback and mutual interdependence.

Analyzing the importance of transportation, it is worth mentioning that it favors both the economic and socio-cultural activation. This is especially important for underdeveloped areas. Communication also strives to maintain social and public order. It enables and facilitates equity of cultural level and intensity of the socio-political life of the population. Transportation is also involved in the development of science and technology and has a significant impact on equalizing their levels with respect to a given country and the world. Transportation mainly facilitates contacts between people and assumes a significant role in the development of tourism, and therefore it is so important both economically and socially.

Working toward increased efficiency of the transportation process, its costs and fulfillment of transportation orders are first analyzed. With the availability of costs, one strives mostly to reduce these costs. The main factor influencing this are charges associated with the use of fuel. Significant are the optimal conditions for fuel acquisition and reduction of its use.

The last few years have seen a continuous increase in fuel prices, necessitating the transportation companies to prioritize minimizing its consumption through implementation of various technical and technological solutions. A similar situation concerns road fees which are more often applicable on national roads and abroad. All this forces transportation companies to increase their consideration of using IT systems and satellite navigation in their business.

5 The objectives of using the GPS

The satellite navigation system has a very wide range of operation. However, it is most commonly used is transportation management. On the market, there are a number of outsourcing companies sharing with businesses the data coming from the navigation system through browser web pages. This enables, among other things, tracking the vehicle's position in real time and recreating its route. It is equally important to have the opportunity to maintain a database of vehicles, which greatly improves the management of the company (Ciesielski, et al., 2010, p.135).

The Global Positioning System (GPS) can be classified as a fundamental IT system used in transportation companies. It not only allows one to position objects, but also supports the process of control and monitoring of the vehicle fleet. Its use reduces the operating costs of the company by providing rapid and accurate information on objects' location. An employee coordinating the operation of the system is able to quickly notify the drivers of the fastest and safest route.

The system has a decisive influence on the improvement of the efficiency of route-planning thanks to regularly updated maps and system data. Being aware, e.g., of traffic obstructions, one can include this data already during the process of route-planning, which will, in turn, significantly reduce transportation costs. The system also helps the drivers demonstrate more discipline due to the fact they are being continuously monitored. Apart from that, this continuous control contributes to eliminating violations and hence accelerates the handling of transportation orders (cf. Kulińska, et al., 2014; Kulińska, et al., 2014; Kulińska, 2014).

Definitely a great advantage of the system is the possibility of using it in emergencies, such as car accidents, where it allows for quick tracking of the vehicle and therefore facilitating rescue operation. The system may find a similar application in a crisis situation, such as the vehicle being subject to assault. The person controlling the fleet will be then able to track the vehicle which will greatly improve the effectiveness of police action (Brzezinski, 2006, p.206).

The satellite navigation system enables to register the vehicle parameters. It displays the speed at which the car is moving, its route and its engine load. The GPS offers benefits not only for the company, but also for the drivers due to the fact that modern technology comes with information on parking space and available gas stations. The positioning system allows for precise determination of the term of transport operation data. This information allows, in turn, for best use of company resources, i.e. drivers or vehicles (Mindur, 2012, pp.555-558).

In order for a satellite system to work properly, the signal must be transferred to the receiver immediately and be transmitted from the appropriate number of satellites. For the signal to be transmitted free of noise, one must locate the receivers in open space with good visibility of the sky. Interference to signals occurs when the sky is obscured, e.g. by trees in the forest or tall buildings in the city. Errors in satellite systems occur when transmitted signals bounce off the metal surface. Nowadays, satellite signals are not reliable when the receivers are located in closed spaces, which usually results in the signal being either very weak or distorted.

Similar to any other device, GPS units are also prone to measurement errors. Such errors can be the consequence of natural or technical causes. The most common causes of error occurrence in satellite system positioning are:

- Delay of the satellite signal passing through the ionosphere. Error value caused by this delay is in the range of a few meters. Ionospheric error occurs in the top part of the atmosphere and is caused by ionized gases in this area. The gases produced by solar radiation and strength of the solar wind trigger changes in frequency and thus in the speed of electromagnetic waves.

An electromagnetic wave passing through the ionosphere becomes distorted since the wavefront slows down while the phase of the wave speeds up, as a result contributing to calculation errors. Users with access to the receivers receiving two frequencies are able to correct these inaccuracies almost completely. This is because of the ability to receive signals of both frequencies and calculate on their basis an appropriate location. Civil users can calculate the error only partially (Januszewski, 2007, p.73).

- Delay of the satellite signal passing through the troposphere. An electromagnetic wave passing through the sphere covering the area of up to 10km above the Earth's surface is slowed down. It is mainly due to wave's interaction with dry air, and to a lesser extent its reaction with steam.

In practice, it is possible to almost completely eliminate this error by determining relevant models that account for the height of the satellite and meteorological parameters in the place of positioning (Frączyk, et al., 2014).

- Multipath signals. Analyzing the work of the GPS, it is assumed that the signal transmitted by the satellite goes directly to the user.

In practice, however, there is a variety of possibilites where the the signal bounces off different surfaces (e.g. airplane's) before reaching the receiver. The resulting positioning error is difficult, and, in many cases, practically impossible, to estimate.

- Satellite clock error. Clocks placed on satellites indicate very accurate time values, while clocks placed in receivers and ground-based control stations are of inferior quality, which causes the time to transfer the satellite signal calculated on Earth to differ from the time indicated by the precise satellite clocks. It is estimated that the resulting errors can reach values up to 1 m.

The satellite clock error can still be eliminated since the two calculated times tend to compensate one another. This is due to the fact that both control stations and users receive the same satellite data (Lamparski, 2001, pp.426-427).

- Ephemeris error. The coordinates of a satellite are called its ephemera. Hence, the ephemeris error displays differences between the actual satellite position and its ground-based location calculation. The resulting positioning errors generally do not exceed 3m. The factors influencing the occurrence of these errors include: gravitational field of Earth, Sun and other celestial bodies at an appropriate distance from the satellites, atmospheric resistance as well as ocean and crustal tides (Lamparski, 2001, pp.426-427).

- Geometric factor. Time of the user pattern and accuracy of positioning depend on the dimensionless DOP (dilution of precision), which combines pseudo-distance measurement error with positioning error. It is important for this factor to be as small as possible since the smaller the DOP, the higher the accuracy of positioning (Januszewski, 2007, p.74).

- Ignorance of geophysical phenomena models. In calculating satellite signals, it is important to account for natural factors, such as all kinds of tides that occur on Earth's surface (crustal, oceanic, atmospheric) as well as movement of the tectonic plates.

These factors make control stations naturally change their position and thus their distance from the satellites, and failure to include these elements in the calculation process may trigger positioning errors. Precise location data can be of significant importance to overall measures.

- Errors resulting from satellite disruptions. Until 2000, civil users of GPS obtained information on the location with an error value of tens of meters, deliberately introduced by system owners. Since May 2000, the distortion is no longer applicable.

The reason for the emergence of positioning errors is also the receiver itself. Oftentimes, the device generates noise disrupting proper reception of signals transmitted from satellites (Frączyk, et al., 2014). There is plenty of reasons for the occurrence of technical errors associated with positioning: they may also be caused by the use of inaccurate software or by mistakes made by the employees of ground-based navigation systems. The most common method that helps remove most positioning errors is called DGPS (differential global positioning system). It comprises a reference station functioning in a specific location, as well as calculating and transmitting by radio appropriate enhancements that are to be applied to the previous GPS measurements (Lamparski, 2001, p.428).

6 The characterstics of Opawy and Eurotramping

The research in this field was conducted based on a group of companies providing transportation services. Among the surveyed companies, those that were considered the most representative in terms of discussing the research topic were selected.

Opawy is a company that has been operating on the Polish tour operator market since 1995. The company specializes in organizing trips to the Czech Republic, Slovakia and Italy. Over a period of a few years, Opawy established close relationship with tour operators and accommodation facilities in these countries, allowing the company to offer a wide range of events and services on, arguably, the most favorable conditions in Poland. Their offer, which is being constantly expanded, includes several domestic and foreign trips.

In addition, Opawy offers all-year-round holiday packages to most countries in the world, serving as the representative of travel agencies such as: Itaka, Sun Fun, Vizier, Gti Travel, Alfa Star, Exim Tours, Eccoholiday, Almatur and many others. They also sell travel insurance (TU ALLIANZ, SIGNAL IDUNA), EURO 26 cards, as well as coach and airline tickets (Kulińska, 2015).

In search of further expansion of their network, Opawy have been striving to explore new and wonderful parts of Europe. Because of this, the company’s offer becomes more attractive every year, so as to meet the needs of different customer groups, from students to the most demanding vacationers. Opawy offers the following services: business excursions, training courses, special events, school trips, business trips, social events, airline tickets, coach tickets, individual stays, insurance.

The second of the analyzed businesses is a travel company Eurotramping that has been successfully organizing overseas trips for children and young people for over 20 years. A total of 375 000 people have so far participated in foreign trips and school camps organized by the company. A number of major foreign contractors repeatedly emphasize that Eurotramping is the leader of school tourism in Poland.

The company is a member of the Polish Tourism Board and has the tour organizer authorization no. 077. Eurotrapming is insured with the Association of Insurance and Reinsurance WARTA S.A., in accordance with the requirements of the Tourism Act.

Their offer is one of the lowest-priced in the country, with a variety of options to choose from. The basic tour price approximates the price of the transportation ticket. Using reliable margins, Eurotrapming is able to offer low prices while maintaining the crucial conditions that make the trip comfortable, namely safe transportation and experienced staff.

The office offers group and individual tours to France, Italy, the Great Britain, Scandinavia, Spain, Germany, the Benelux, Greece, Croatia, Denmark, Hungary, Slovakia and the Czech Republic. It also organizes on-demand plane trips to Egypt, Tunisia, Turkey and the Greek islands.

Along with the increase in demand for passenger transportation services, both companies have expanded their service offer and improved their respective infrastructure.

They use comfortable coaches, such as the latest vehcicles by Setra, Man, Mercedes, Neoplan, etc., which are equipped with: toilet, DVD (2 monitors), cafe bar, air conditioning, reclining and movable seats with armrests and footrests.

In addition, the coaches come with ABS, ASR and a sleeper cab for the driver. They comply with safety sand environmental standards EURO II, III or IV. Their engine power makes for a very efficient and safe drive in mountainous regions. Depending on the route length, the coach is operated by a total of two to four different drivers (Kulińska, 2015).

Figure 1. Coach SETRA S 416 HDH
(*source:* Eurotramping's materials)

COACH Setra S416 HDH – 58 seats (55+2+1), equipped with air conditioning, Blaupunkt - Coach 2000 DVD radio set, DVD, two 19-inch monitors (liquid crystal), toilet, cafe bar, kitchenette, refrigerator, air conditioning, reclining and movable seats with leather headrests, armrests and adjustable footrests, folding tables by each seat, large space between the seats (which significantly increases travel comfort), overhead night lamp, overhead air vent, curtains (Kulińska, 2015).

COACH MAN RHC464 – 59 seats (57+1+1), equipped with air conditioning, DVD, 2 monitors, toilet, cafe bar, reclining and movable seats with armrests and adjustable footrests, folding tables by each seat, overhead night lamp, overhead air vent, curtains, seatbelts (Kulińska, 2015).

Figure 2. Coach MAN RHC 464
(*source:* Eurotramping's materials)

COACH NEOPLAN N 316 SHD, in two versions: Transliner – 51 seats (49+1+1) and Euroliner – 52 seats (49+2+1). Both equipped with: air conditioning, video/DVD, 2 monitors, toilet, cafe bar, reclining and movable seats with armrests and adjustable footrests, folding tables by each seat, overhead night lamp, overhead air vent, curtains, seatbelts in unsecured seats.

Figure 3. Coach NEOPLAN N 316 SHD
(*source:* Opawy's materials)

7 Operation of the companies before using the GPS

It was proposed that, among other things, the companies need to invest in monitoring of their vehicle fleet. Until the implementation of the system, they would operate on different principles than they do today. When planning the route for transportation of goods to a particular destination, they relied solely on paper or website maps. For fulfilling its service, the owner could only roughly determine when the driver was going to reach the destination. This greatly complicated business operation since the exact time of transportation was not known and therefore clients could not be provided a specific time of delivery. Clients, however, often required such information from the owner, forcing them to choose one of the two following options:

- Provide an estimated time of delivery, taking into account client's requirements for the fastest delivery. In this case, the owner would risk the employee not being able to reach the destination on time, and thus making the service be provided not in accordance with client's requirements. This would result in an unsatisfied customer and possibly their loss for future orders.

- Provide a safer (i.e. later) time of delivery, and thus decrease business performance. The owner would be then exposed to unnecessary additional costs, such as parking fees or extra working time of the driver. Another disadvantage of this option was the fact that the time of order fulfillment was longer, making the company's offer less convincing in the eyes of potential clients.

The companies also faced problems when the driver experienced atypical cases on route, such as detours, road constructions or traffic accidents. In that situation, the driver had to rely mainly on their individual skills, which resulted in additional fuel costs (due to searching for a new route) as well as costs associated with delayed deliveries and longer working time of employees.

Before using the GPS for tracking vehicle fleets, company managers had to plan routes in advance. Such operation of the travel companies was underdeveloped in terms of logistics, which why the managers – in an attempt to improve the quality of services and create a better working environment for all employees – decided to start using satellite navigation systems in order to track their vehicles (Kulińska, 2015).

8 Operation of the companies after using the GPS

The companies participating in the research expanded their infrastructure and started using the GPS linked with GSM for a number of reasons. GPS makes it possible to track an object virtually anywhere on Earth, while the GSM is responsible for transmitting information from the vehicle to the company. The companies that took part in the research started to use the system through outsourcing, with the information being made available to them via websites.

Both technologies, i.e. GPS and GSM, were implemented in all of the coaches. As a result, the companies using the application, after logging in to the website, gain access to all details about their coaches. A map is displayed where one can see the vehicle's geographical position and its registration numbers, with the position being tracked in real time. The companies have access to information related to the location of their vehicles in any place in the world. The only requirement is access to the Internet since the owner receives data via the website www.poltrack.pl.

To retrieve information about the location of the coach, one needs to log in to the above website and then freely use the GPS available in it. It is important to note that the information is made available only after successful user identification, as a way of protecting company data against undesired enquirers. System data are sent to the database with only a 20-second delay, which enables quick response in the event of an unannounced change of route by the driver or if a vehicle gets stolen. The devices make it possible to track vehicles in any part of the European Union, significantly facilitating control over them.

By implementing a GPS-based monitoring system, each of the companies had to invest 500 PLN, which covered the cost of locating devices and their installation in vehicles. The *q2 mobile* locating devices occupy the lower part of the engine, out of reach for the driver. They are also small, which is another advantage of this system. The device does not in any way affect vehicle performance, and its discreet location allows for quick removal in case of, for example, theft. Apart from all this, these devices are durable and have a long working time.

The companies using the satellite navigation system in their cars are also subject to license fees for each vehicle.

Vehicle tracking is not just about controlling geographic position of one's fleet. The companies also have access to information such as as engine performance. As a result, the owner has control over the functioning of their drivers as they are kept up to date about how the engine is run, whether it is used economically, and whether employees do not overload it.

The information retrieved through the vehicle monitoring system also allows for ongoing control over mileage. The owner has insight into current mileage information for all of their vehicles. Additionally, the tracking process includes continual reporting on how fast the vehicle is driven on the road. The owner can therefore, at any time, prove to an employee that they have been driving either too slow or too fast. Such information enables the owner to control not only the vehicles themselves, but also the drivers. By analyzing the retrieved data, one is able to notice which employee performs their duties diligently, and which one puts tour participants, the vehicle and themselves at risk, higher costs or other problems.

By using the GPS-based vehicle monitoring system, the companies not only can monitor the performance of their employees, but at the same time also make their job a lot easier. Knowing the position of the vehicle, the employee coordinating the route is able to quickly notify the driver of a safe place to take a break during the drive. Important information that can be conveyed to employees by the owner is with regard to, e.g., the nearest gas station.

It is a common occurrence for a car to warn the driver about fuel shortage, which is highly critical when time is especially of importance. The receipt of information about the nearest station by the driver via the mobile phone reduces the time of its search and makes the drive stress-free since the driver knows they have enough fuel to reach the nearest gas station.

The benefit of using the system in transportation services is its continuous management by the person logging in to the website. The user, e.g. owner of the company, can at any time disable vehicle monitoring. A decisive advantage of the monitoring system is the ability to reset the locating devices by the operator sitting at the computer. A disadvantage, meanwhile, is that these devices must be periodically switched off and on. There were instances when the device located a vehicle in the company's office, while in fact the driver was already at the client's. The owner would then have to reset the GPS receiver online for a given vehicle in order for the correct information to be saved in the database.

In the age of today‘s rush and high expectations of clients, the company is able, with a great ease and in a flexible manner, to meet these demands after implementing the system in their vehicles. The GPS streamlines the processes of transportation, not only serving owners in terms of vehicle control, but also helping drivers better perform their job (Kulińska, 2015).

9 GPS performance in the researched travel agencies

When analyzing the impact of the GPS linked with GSM, it is worth having a closer look on its performance. The system, to which the companies have access, offers a lot of useful options. Upon logging in to the appropriate site, a coordinator has access to a map which displays the current location of the company's coaches.

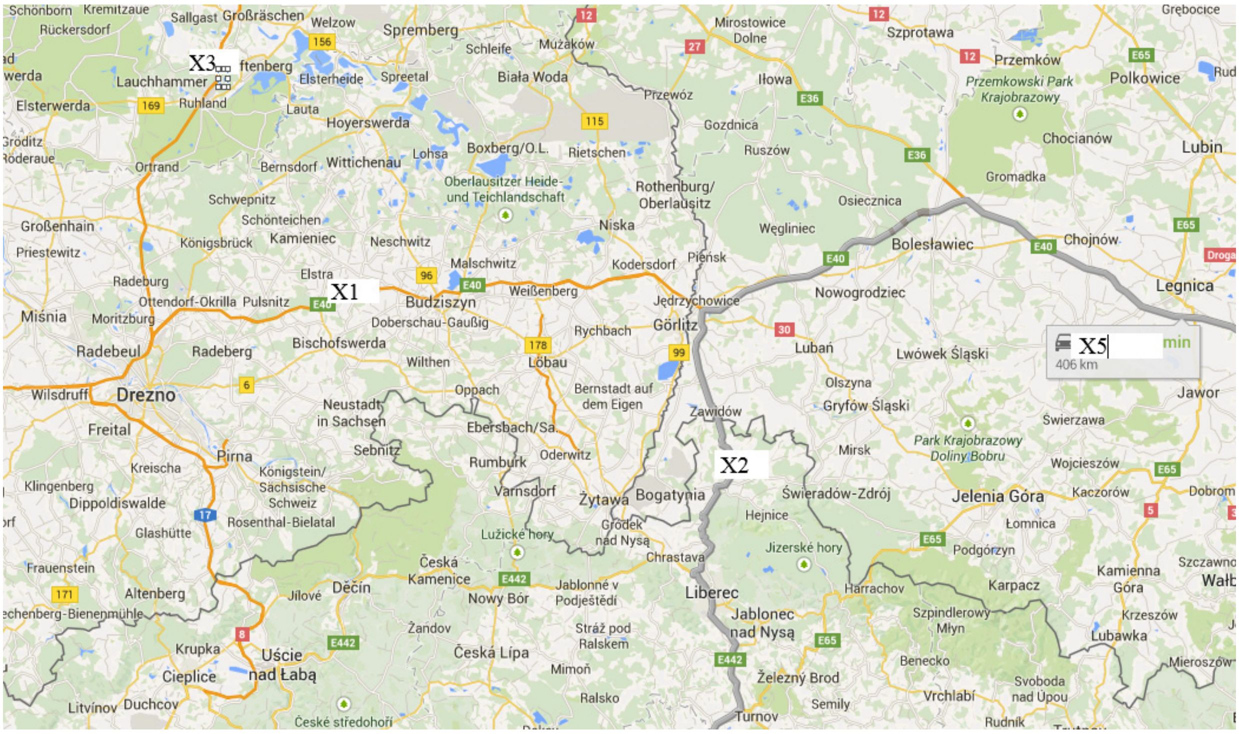

Figure 4. Map showing the location of the coaches
(*source:* Eurotramping's materials)

The map available on www.poltrack.pl, used by the owner of the company, is detailed. Therefore, one can accurately determine the location of their vehicles. In the example map (Fig. 4), there are four coaches on the route from Opole to Prague.

If the coordinator is interested in retrieving information on one of the coaches and would like to see where this coach is at a given moment or what route it traveled in a given time, they simply need to type in the vehicle's registration number and the relevant data will be displayed automatically.

The route coordinator has access to the entire route of the vehicle, from the moment of it leaving the office, through a series of stops and destinations, to the coach's place of return. If the owner of the company wishes to conduct a monthly analysis for a vehicle, all they need to do is specify the time range and enter the registration number of the coach.

As can be seen, the company may at any time check what route was traveled by a given coach. Such map facilitates planning future routes and gives the owner an opportunity to both modify them and improve them in terms of logistics. By having access to such data, costs resulting from different fees and charges can be reduced as well. These costs include fees due to: parking space, highway tolls in different countries, bridge-crossing charges, and tunnel-crossing charges.

The GPS used by the offices not only helps in devising new routes, but also contributes to continuous improvement of the existing work of the drivers.

The vehicle fleet monitoring system aims not only to control the drivers and offer support in planning routes. It also helps the driver reach their destination smoothly. It often happens that, abroad, the roads are built very densely and the new ones are constantly under construction. The driver is equipped with a GPS receiver, but it is not always up-to-date with current developments. This often results in the driver having a problem finding the right road. Typically, this happens right at the end of the route, when the driver needs to locate the exact address. The coordinator may then easily solve this particular issue. The driver calls the coordinator, who immediately logs in to the website and finds out about the exact location of the employee and their destination. The maps available on *www.poltrack.pl* are updated on a regular basis and are very accurate, allowing the coordinator to precisely inform the driver of how to reach their destination, indicating a particular street or exit. This significantly improves the quality of services and also reduces the costs associated with fuel and extra work performed by the driver.

A noteworthy advantage of using the GPS to track vehicles is definitely the possibility to work out a plan for vehicle refueling. Knowing fuel consumption of each of the vehicles, as well as the route to be traveled (e.g. when it is the same as last month), the coordinator and the driver are able to plan out the most cost-effective "pit stops". Such plan will help reduce the cost of the service and will prevent situations in which a driver runs out of fuel.

With a range of options offered by the GPS, the company has the ability to very accurately determine driver's location not only in the form of an image on the map. As can be seen in Tab. 1, information in numerical form is also displayed.

Table 1. Details on the location of the coach
(*source:* Eurotramping's material)

Vehicle	AA1111C
Date and time of the last registration	2014-12-22 17:43:47
Latitude	51.5359
Longitude	7.98418
Speed	93
Counter	398 689.49
Fuel level	-
Voltage power supply	13 806

Therefore, it follows that on 22/12/14, the coach registered as X1 was located at the given latitude and longitude, moving at the registered speed of 93 km/h. An interesting piece of information is that indicating the vehicle's mileage and voltage power supply. Displayed is also the name of the location where the vehicle was located at a particular time. In this case, it was: A44, Höhberg (0.3 km), Niederense (4.5 km), Soest, DE-59457 Deutschland.

The website that provides data on the location of each of the coaches has the possibility to generate reports on working time of each of them. These reports can relate to different time ranges. They are displayed in the form of a table. If the company is planning to perform a specific service within a given time, one can enter such information into the system. Upon entering of this data, there is an option of comparing the plan to the actual situation. The program also enables to compare the values defining the working time of each vehicle. It also generates an average value of time during which the cars have been used.

Table 2. Monthly report of the working time of the vehicles
(*source:* Eurotramping's materials)

AA 1111C				
Object		Distance for the period		Time spent in the zone for the period
		Plan	Fact	Other
X1		0	0	627
X2		0	1 4038	476
X3		0	1 0730	589.9
X4		0	0	505.3
Average	**4**	**0**	**6 192**	**5 49.6**
Together	**4**	**0**	**24 768**	**2 198.2**

As can be seen (Table 2), within one month, the cars belonging to *Opawy* spent an average of 548.6 hours on the road, which adds up to 2 198.2 hours of work for all vehicles combined. At the time at which the report was generated, the owner did not introduce the planned distance value for the period, which is why the numbers presented indicate zero. The company is also able to generate a daily report for each of the coaches (see Table 3).

A daily report for the coach X1, dated 02/12/14, indicates the exact time of vehicle operation and its "downtime". Valuable information is also an indication of the point when the coach X1 has its engine running and turned off, as well as the speed at which the driver was moving. This ensures that the company owner has direct control over their employees and therefore over their financial interest. Another piece of curious information retrieved by the company is engine performance for a given vehicle. This information allows the owner to compare data of the distance traveled according to the GPS and according to the vehicle's mileage. Sometimes, these data slightly differ, although they usually indicate similar values.

The company is able to retrieve the history of the route for each of their vehicles. The possibilities offered by the system are extensive as the data thus obtained is very detailed. Route history is generated for different periods of time and can be made for each of the coaches. The owner, wanting to examine thoroughly the work of the driver, needs to type in the registration number of the vehicle and the relevant time range.

Before using the system, the companies had to call the driver each time, asking where they were more or less at that precise moment. Unfortunately, this information was often conveyed in approximation or simply was not true. Investing in the GPS, one not only receives accurate position data, but also saves the money that would normally be spent on telephone conversations between the drivers.

The company investing in the GPS has gained the ability to report on vehicle operation and thus the work performance of their drivers. Upon choosing the corresponding option, the system generates a report containing operating hours for each of the vehicles.

Table 3. Daily report for the coach X1
(*source:* Eurotramping's materials)

Nr.	Date / Time		Speed	Engine	Counter
1	2014-10-26	12:16:34	0	Of	383523.91
2	2014-10-26	12:16:34	0	Of	383523.91
3	2014-10-26	12:16:36	0	Of	383523.91
4	2014-10-26	12:16:53	0	Of	383523.91
5	2014-10-26	12:16:55	0	Of	383523.91
6	2014-10-26	12:19:31	0	Of	383523.91
7	2014-10-26	12:19:35	0	Of	383523.91
8	2014-10-26	12:19:36	0	Of	383523.91
9	2014-10-26	12:19:43	0	Of	383523.91
10	2014-10-26	12:26:31	13	Turn on	383523.99
11	2014-10-26	12:26:33	16	Turn on	383524.0
12	2014-10-26	12:26:57	11	Turn on	383524.1
13	2014-10-26	12:26:58	11	Turn on	383524.1
14	2014-10-26	12:26:59	12	Turn on	383524.1
15	2014-10-26	12:27:00	15	Turn on	383524.1
16	2014-10-26	12:27:35	13	Turn on	383524.39
17	2014-10-26	12:27:38	7	Turn on	383524.4
18	2014-10-26	12:27:39	10	Turn on	383524.39
19	2014-10-26	12:27:40	14	Turn on	383524.39
20	2014-10-26	12:27:41	16	Turn on	383524.39
21	2014-10-26	12:28:23	51	Turn on	383524.89
22	2014-10-26	12:29:22	54	Turn on	383525.4
23	2014-10-26	12:29:33	55	Turn on	383525.9
24	2014-10-26	12:29:55	19	Turn on	383526.19
25	2014-10-26	12:30:16	15	Turn on	383525.91
26	2014-10-26	12:30:17	13	Turn on	383525.91
27	2014-10-26	12:30:18	12	Turn on	383525.91
28	2014-10-26	12:30:19	19	Turn on	383525.96
29	2014-10-26	12:30:30	18	Turn on	383525.92
30	2014-10-26	12:30:33	18	Turn on	383525.93

Tabel 4. The report on the vehicle's operating times
(*source:* Eurotramping's materials)

2014-12-01		
Start	Stop	Price
00:00:00	00:17:10	00:17:10
00:22:41	00:40:18	00:17:37
00:43:21	00:48:11	00:04:50
06:56:39	10:20:05	03:23:26
10:20:53	10:23:28	00:02:35
10:27:13	10:28:39	00:01:26
10:53:36	11:57:13	01:03:37
11:58:07	12:01:16	00:03:09
12:15:16	13:26:53	01:11:37
13:32:33	13:34:34	00:02:01
13:37:16	14:12:39	00:35:23
14:13:19	14:15:10	00:01:51
14:38:58	14:56:35	00:17:37
14:56:38	15:17:59	00:21:21
15:29:56	15:31:30	00:01:34
15:39:05	16:36:35	00:57:30
17:00:28	17:17:37	00:17:09
17:44:31	17:55:19	00:10:48
Start: 00:00:00	Stop: 17:55:19	Total: 09:10:41

As can be seen (Table 4), the report contains very detailed information. It specifies the time when the vehicle began to operate and when it halted or changed the route. The provided data have the accuracy of one second. In the third column, one can notice that the system calculates the time between the start and the end of a given section and displays the corresponding value. At the end of each day of vehicle operation, the system generates a summary report that comprises the following: start of work, time of work completion, time during which the coach has been used. The report generates not only daily reports, but also weekly and monthly reports.

Between 05/12/13 and 11/12/13 the coach X2, fulfilling orders in the same area as currently, covered the 3 713 km-long route, which is relatively longer than the ones covered now. This may be due to a number of reasons, such as: kilometers traveled during looking for a suitable parking place, kilometers traveled in search of a gas station, kilometers traveled in search of a pickup place of the tour group, kilometers traveled due to personal reasons.

The reasons may be many since, prior to using the GPS, the driver was forced to rely only on themselves in non-standard situations, and the owner had no real control over their work.

Table 5. Transit datasheet for the coach X2 before and after the GPS implementation
(*source:* Eurotramping's materials)

Study period	**05/12/13 – 11/12/2013**	**01/12/14 – 07/12/14**
Engine runtime	72 h	62 h 36 min 15 s
Distance covered	3 713 km	3 604.4 km

Analyzing the above data, it can be concluded that the coach X2, fulfilling similar orders, required nine more operating hours. The driver also traveled 108.6km more than they do now under similar terms of contract orders.

Evaluating the presented data, the conclusion can be reached that the GPS became a solution to the problems of additional costs. Apart from these savings, the company also gained financial benefits arising from smaller fuel charges.

Let us assume that the average coach burns roughly 12,1L of fuel per every 100 km. With a smaller mileage, owing to the implementation of the GPS by the company, this can save up to several hundred PLN a month on fuel alone. Knowing the difference in the distance covered (108.6 km), value of fuel consumption (12.1 l/100 km) and the average price for a liter of fuel in the years 2013/2014, one can calculate how much the company saved in the working week of one driver.

Table 6. Average diesel oil prices
(*source:* http://moto.money.pl/ceny-paliw/#polska,0,olej_napedowy: 02/07/16)

Year	**2013**	**2014**	**2015**	**Average**
Diesel oil price at the end of the year [PLN /l]	5.39	4.94	4.29	5.36

Burning approximately 12.1 l of fuel per every 100 km, the coach would consume exactly 13.032 l of diesel oil after traveling 108.6 kilometers. Based on the average diesel oil prices during the time of GPS implementation in the company, it can be concluded that the company saved about 69.85 PLN per week. If one were to apply these savings to all company's cars, they would add up to 279.4 PLN per week and 1 117.6 PLN per month. With the cost of GPS implement reaching, at that time, 8 556 PLN, it can be said that the use of this system in the company proves beneficial, not only in the process of route-planning, but also in terms of company's profitability.

Table 7. Savings
(*source:* Eurotramping's materials)

Estimated savings	53 644.8 PLN
System implementation costs	8 556 PLN
Profits due to system implementation	**45 088.8 PLN**

Needless to say, the indicated research sample is too small to draw any objective conclusions. However, after analyzing the data retrieved from *Eurotramping* and *Opawy*, it can be seen that, thanks to the GPS, both companies boosted their profitability. In addition to the profits arising from fuel charges, the savings also included telephone conversations with drivers as well as road tools and bridge-crossing charges. Furthermore, the profits also apply to labor costs of employees. Comparing the working hours of drivers before and after using the system, it can be observed that one driver spent nearly 10 hours less to cover the same route.

Faster delivery allows for fulfillment of more orders and, in turn, generates additional income (Kulińska, 2015).

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