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ENVIRONMENTAL PERSPECTIVE OF LOCATION BASED SERVICES AND LIGHT GOODS VEHICLES IN URBAN AREAS

Zbyszko Pawlak

Poznan School of Logistics, Poznan, Poland

ABSTRACT. The article looks at the underexplored area of light goods vehicle (LGV) operation. Specifically, it is investigated to what extent various location based services (LBS) can be applied in the context of LGV operation in order to improve their environmental friendliness in urban areas. In doing so, LBS applied in real time navigation, dynamic fleet management, freight tracking and monitoring, hazardous materials transport, location-specific tolls and taxes and geo-eco-driving are described in relation to their usefulness in LGV operation as well as the potential in reducing LGV-originating pollution. Where available, real world examples of such applications are given. The discussion reveals particular significance in that context of real time navigation and dynamic fleet management, which are widely applicable solutions in LGVs operation. Freight monitoring and tracking, including hazardous materials transport, have been also found to be of an importance due, yet with a more limited applicability. As regards location-specific tolls and taxes, and geo-eco-driving, significant potential of these LBS has been identified, yet due to their very limited applicability in general, no robust conclusions could be drawn. Last but not least, a significant gap in the detailed knowledge regarding the area has been revealed and directions for further research have been suggested.

Key words: location based services, urban areas, environmental friendliness, light goods vehicles.

INTRODUCTION

Road-based freight transport remains a vital element of each country's economy. Not only does it support various sectors enabling physical flow of goods, but it also contributes to gross domestic product generation through various value-added logistic services [Christopher 2005]. In terms of international or interregional movement of goods, road transport could theoretically be substituted with rail, water and air transport. However, in case of a more localised movement (intra-regional, intra-urban), it does not have a practical alternative due to its enormous flexibility and well-developed as road networks are almost always by far denser than railway or water networks [Browne and Allen 1999]. Nonetheless, within the road transport sector, various branches possess properties, which make them suitable in particular contexts. A very most general, yet sufficient for the purpose of this paper, division of the sector is into two groups: heavy (HGV) and light (LGV). Whereas heavy goods vehicles are in general more suitable for longer distances, single pick-up and delivery points (e.g. between logistics centres), light goods vehicles prove more useful and profitable in densely built-up areas with multiple pick-up delivery points and heterogeneous loads [Browne et al. 2007].

Despite the apparent complementarily between the sectors, LGVs have been receiving much less attention from researchers as compared to HGVs (especially those operating within fleets for which large operation research exists). At the same time, however, their contribution to environmental

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problems is considerable and dynamically increasing [Jorgensen 1996]. In order to mitigate these effects, various economic measures trying to control the demand for freight transport or technical solutions improving efficiency of the vehicles have been applied in the sector. However, also the rapid development of Information and Communication Technologies (ICTs) has provided a number of novel solutions, which could potentially reduce the negative impact of LGVs' operation. A certain type of such solutions is Location Based Services (LBS), which make use of the positioning ability (usually satellite-derived), mobile internet and electronic spatial databases. Their exceptionality derives from the fact that by taking into consideration individual's position and thus geographical context, such solutions can provide a range of highly personalised and well-suited services. However, the applicability of the LBS in the context of environmental friendliness of LGVs has not been properly explored yet.

The aim of this article is therefore to investigate that area. The structure of this paper is as follows. The first section includes description of the significance of light goods vehicles in terms of their contribution to economic growth, pollution generation and measures reducing their environmental impact. The second section explains and describes the concept of location based services, providing examples of their applicability. The third section presents the location based services as applied to light goods vehicles' operation, in particular: real time navigation including traffic data, dynamic fleet management, hazardous materials transportation, freight tracking and monitoring, location-specific taxes and geo-eco-driving. The next section looks at the aforementioned aspects from an environmental perspective by looking at their usefulness in reducing the light goods vehicles' negative impact on the natural environment in urban areas. The last section draws final conclusions and suggests directions for future research.

LIGHT GOODS VEHICLES

Light goods vehicle (also referred to as light duty vehicles or commercial vehicles) are vehicles for professional usage whose laden weight does not exceed 3.5 tonnes' (Joumard et al. 2003: 5217). While in general they perform similar role to heavy goods vehicles in terms of transporting freight, they remain very differentiated in terms of a detailed design which reflects their flexibility in operation. Jourmard et al. (2003: 5217) suggest six types of LGVs:

- commercial cars, passenger for professional use;
- light vans, similar to passenger cars but modified for professional use in terms of body and motorisation;
- terrain vehicles;
- pick-up trucks with a rear platform;
- vans with 2.5 tonnes of laden weight derived from passenger car technology;
- vans with laden weight from 2.5 to 3.5 tonnes, derived from truck or passenger car technology.

However, LGVs differ from HGVs not only in terms of laden weight and size, but also in terms of the tasks performed. LGVs are far more suitable for densely built-up, with narrow streets, heterogeneous loads and lack of additional infrastructure for freight handling [Browne et al. 2007]. What is also specific for LGVs is also the fact that they can be used commercially in fleets (e.g. TESCO's home delivery trucks), commercially individually (e.g. to supply own shop) as well as for private purposes such as leisure trips [Browne et al. 2004]. These features mean that is important to recognise LGVs operational context can be very different from that of HGVs. As a result, what may prove efficient for HGVs may not be similarly well performing for LGVs. For instance while improved engine efficiency at cruising speeds may be suitable for HGVs which tend to cover longer distances on motorways maintaining constant speed, in case of LGVs this solution may not be that significant. At the same time, reduced fuel consumption during pulling out may be more suitable for LGVs which often operate in congested urban areas as opposed to HGVs. In other words, light goods vehicles due to their very differentiated contexts of operation require technological solutions which can adapt to differentiated character of operation.

Despite being smaller and lighter as compared to heavy trucks, light goods vehicles are far less efficient in terms of fuel consumption and emissions per unit of freight transported [Jorgensen 1996]. What is more, LGVs turn out to be more polluting than passenger cars due to their size, character of usage and longer distances covered [Browne et al. 2007]. In other words, they underperform HGVs in terms of goods transportation, and also are more polluting than passenger cars if used for private purposes [Pawlak 2007]. Despite these facts the amount of goods transported by LGVs have been steadily increasing due to a number of reasons [Browne et al. 2004]:

- increased popularity of Just-In-Time (JIT) deliveries requiring more numerous, yet smaller deliveries;
- more deliveries of critical importance which cannot be stored for a longer time;
- greater difficulty to hire HGV drivers and operate HGVs due to various regulatory measures;
- various restrictions for HGVs' operation in urban areas, e.g. emission, axle weight;
- more home deliveries resulting from increased popularity of e-shopping;
- increased number of households requiring more home wares and shopping deliveries.

What is even more appealing as a result of these trends is that the LGVs CO_2 emissions are expected to increase even though European objectives are to cut overall CO_2 emissions by 20% till 2020. For instance, in case of London the LGV-derived CO_2 emissions are predicted to rise by 152% by 2050 if current trends continue [Zanni and Bristow 2010]. Moreover, the increased number of LGVs can, by contributing to traffic congestion, have a knock-on effect on emissions from other traffic. As Kanaroglou and Buliung claim, such an effect can be of a very significant size. In their investigation they estimated that under certain conditions an increase of 4.4% of vehicle miles covered as a result of presence of goods vehicles can lead to an increase in particle matter emissions by 111% [Kanaroglou and Buliung 2008].

Since the environmental implications of the LGVs' increasing popularity are severe, a number of measures have already been proposed to mitigate them. There are four main groups of such measures: logistical, regulatory, behavioural and technological [Zanni and Bristow 2010]. Logistical solutions are focused on the provision of additional infrastructures in a form of Collection Delivery Points (CDPs) or various types of Urban Consolidation Centres (UCCs) [Zanni and Bristow 2010]. In the former case, the CDPs function as pick-up points for any goods that could not be delivered due to the receiver absence. As a result the need for additional LGVs trips is reduced. In case of the UCCs, on the other hand, these publicly owned facilities enable deliveries' consolidation [Browne et al. 2007]. Various types of such centres have been reported to lead to significant improvement of environmental efficiency of LGVs, e.g. even up to 80% decrease in CO_2 emissions [Patier 2007]. Regulatory measures tend to be concentrated on various traffic restrictions and regulations. A number of such solutions such as delivery restrictions, provision of loading/unloading bays and weight access restrictions and use of bus lanes have been applied throughout the world. Nonetheless, their effectiveness in reducing emissions remains unclear as the existing studies provide inconsistent results [Zanni and Bristow 2010]. Behavioural solutions are techniques aimed at improving drivers' skills in terms of efficient use of the vehicles, concentrating on the concept of eco-driving. Savings of about 10% in terms of CO_2 emissions have been reported so far [DfT 2006]. The final set of solutions are technological measures which increase the operational efficiency of the vehicles. Better aerodynamics, tyre inflation controls and can lead to about 30% reduction in fuel consumption [Ang-Olson and Schroeer 2002] whereas adoption of low emission in the United Kingdom has been reported to have a potential of reducing freight emissions by up to 6.4 million tonnes of CO_2 [Banister and Hickman 2006].

Having presented the current measures aimed at reducing the environmental burden of the goods vehicles' operation, it must be noted that that they are not LGV-specific measures. Instead they can also be applied to different vehicles, especially in case of behavioural and technological solutions.

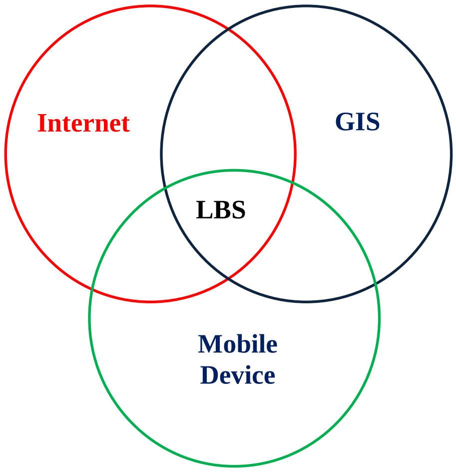
Additionally, what has not been mentioned so far, also the information and communication technologies can play a role in improving the sustainability of LGVs. A branch of which ICT, location based services, are presented in the next section which is followed by exploration of their application to LGV operation.

LOCATION BASED SERVICES

The rapid development of Information and Communication Technologies which has taken place over the recent decades has revolutionised (or at least influenced) almost every aspect of human life, including LGVs' operation. One of the products of this dynamic advance of ICT are location based services. Although there exists no single and standard definition of what LBS are, a widely accepted one is [Virrantaus et al. 2001: 423]:

"Location Based Services are information services accessible via mobile devices through the mobile network and utilising the ability to make use of the location of the mobile device."

A very convenient representation of the concept has been provided by Brimicombe [2002] who defines the LBS as an intersection of three branches of technologies: GIS, Internet and Positioning-capable mobile device (figure 1).



Source: Own elaboration based by Brimicombe 2002

Fig. 1. Location based services as intersection of technologies
Rys. 1. Usługi lokalizacyjne jako wypadkowa technologiczna

Despite being not even a decade old concept, LBS have gained enormous applicability in a great deal of contexts. Steigner et al. [2006] provide six quite distinct examples of the ways in which LBS can be used:

- Emergency services, whereby user requiring assistance (be it a tourist lost in mountain or someone injured) can be easily located and provided with necessary help,
- Navigation services which provide real time routing directions, possibly including information on congestion and other obstructions,
- Information services which give the user advice on the available places of interest in their proximity (shops, pubs, restaurants, pharmacies),

- Tracking and management services which enable to track packages or field personnel increasing their safety or efficiency,
- Billing services which enable the service provider to charge the user with specific charge depending on their location,
- Augmented reality which, although still largely under development, would allow to integrate the location-specific information with real-world environment so that what is seen by the user is augmented with additional information.

In fact, the current and dynamic development of mobile phones (various types of Smartphones, iPhones) equipped with mobile internet as well as Global Positioning System (GPS) module made LBS easily available to each individual at a quite reasonable price. As a result navigating applications, tools locating nearby places of interest or friends have become widespread. To what extent they could be, on the other hand, in the context of LGV operation, is a matter of discussion of the next section.

LOCATION BASED SERVICES AS APPLIED TO LIGHT GOODS VEHICLES

Having explained what is meant by the terms light goods vehicles and location based services, the next step of the discussion is to describe and explain the ways in which the two interact. In doing so, several already existing location based services along with hypothetical ones are discussed in reference to LGVs' operation. Where possible, real-world examples of applications have been provided.

Real time navigation

Real time navigation is perhaps the most popular and widely recognisable location based service in use, also in case of light goods vehicles. Whereas vehicle navigation itself is hardly a new concept, real time provision of maps and driving directions has effectively become available in the last decade with the wider availability of GPS-utilising devices (Garmin, TomTom) and broad-band mobile internet (EDGE, 3G technologies).

Such form of location based services have also found its way to improvement of LGVs operation. Since LGVs are usually driven so as to maximise their efficiency and profitability, any losses resulting from delays (congestion-related or due to being lost) are not desirable. On the other hand, LGVs' drivers quite often operate in areas unfamiliar to them: for instance goods deliveries are made in quite distinct neighbourhoods. As a result, real time navigation whereby the user is provided with actual, almost instantaneous information on where they are and how to get to a destination, has gained enormous popularity. For similar reasons the real time navigation has become widespread among people in general [Shehkar et al. 2004]. Further extensions to the service include calculations of the most optimal (quickest, cheapest) route through the network, consideration of traffic congestion or omission of the road works (with the latter two requiring access to a real-time database with the relevant information).

Currently, a there exists a well-developed market of navigation services [Wang et al. 2008]. The main providers of the navigating devices include Garmin, TomTom, Telenav or Nokia, while companies such as Mapquest, Tele Atlas or Navteq are responsible for developing electronic maps utilised in these devices. Packages such as Sprint Navigation include voice-guided navigation with real-time traffic alerts and possibilities of fast rerouting to avoid congestion.

Dynamic fleet management

As already mentioned, light goods vehicles operating in fleets tend to be utilised under a very tight schedule in order to maximise profitability. Finding an optimal allocation of vehicles to serve multiple pick-up and delivery points, a problem which is often encountered in case of fleet operation especially in urban areas, has been underpinning a great deal of the operational research and mathematical programming, resulting in development of numerous optimising algorithms [Zeimpekis et al. 2007]. Nonetheless, in the past the inherent problem in fleet management was to know exact locations of the vehicles so that allocation could be modified and implemented on real-time bases. With the advent of modern capabilities of each vehicle to constantly locate itself using satellite positioning and communicate with the headquarters via wireless links, fleet operator is able to constantly monitor position and status (e.g. cargo loading, going to destination) of each vehicle. Moreover, it is possible to efficiently manage the fleet by introducing, removing or re-allocating pick-up and delivery points, as well as tasks according to changing conditions. For instance, in case a vehicle breaks down, notification is transmitted to the headquarters which can send a suitable response team. Moreover, other vehicles can be re-routed to serve the locations that were supposed to be visited by the excluded vehicle. The main advantage here is that all this can be done quickly with an aid of the suitable fleet-optimising software. In extreme cases, if the vehicle is stolen, it can be quite readily and easily monitored and retrieved, which increases the security of the load and, indeed, driver's and operator's comfort [Spiekermann 2004].

Certain companies have also started to offer yet another interesting and powerful capability of the vehicle management systems which may supplement real-time navigation systems discussed in the previous section. In such a case, not only information on vehicle's location and status is transmitted to the operator, but also information on the prevailing traffic conditions at its location, especially in areas where such information is not a part of a publicly transmitted service. As a result, vehicles effectively play the role of 'probes' thanks to which fleet allocation can be further enhanced (Supply Chain & Logistics Ltd N/A).

Similarly to real-time navigation, this market niche has also been explored by various companies. Two kinds of actors can be distinguished here. Firstly, there are well-established fleet operators who make use of their own optimising systems, e.g. DHL or Kuehne+Nagel. The second group are service providers which do not operate fleets, but devise software and provide necessary equipment serving the needs of fleet operators, especially smaller ones for whom it is not profitable to devise own computer programmes. Examples of such providers are ShockWatch company with EquipCommand software or Ron Turley Associates.

Freight tracking and monitoring

Freight tracking and monitoring is another location based service, by means of which either operator or the final receiver can constantly follow the location and status of the cargo (Spiekermann 2004). Operation of this service is quite similar to the vehicle monitoring, yet not identical since this time it is the load that is the objective of the service. Nonetheless, information on the status of the load and its current location is in a similar matter transmitted via wireless link to the headquarters which can make it available to the final receiver on a designated tracking service, usually online based.

As a result, apart from allowing to monitor the load in a real time, e.g. if the valuable asset such as piece of art deviated from a designated course, it allows the final receiver to see the estimated date and time of delivery. Hence, the receiver can arrange their daily activity schedule in such a manner as to be able to pick up the load at right time which reduces the risk of the need to make the second delivery/recovery trip [UPS 2010].

Tracking services have already become a standard offer of the logistic companies. As a result, LGV-operating companies such as DHL, FedEx, UPS or TNT have designated systems for load monitoring and tracking.

Hazardous materials transport

Hazardous materials (often shortened to 'Hazmats') are solids, liquids or gases which can pose a threat to health of living organisms, natural environment or property (UNECE N/A). Due to their exceptional nature, they require constant monitoring and tracking by relevant authorities in order to prevent their exposition to vulnerable populations (people, animals) and areas (e.g. fresh water reservoirs). As a result, the location based service looking at their monitoring can be perceived as a special case of freight tracking and monitoring discussed in this paper as a result of the significance for the natural environment.

An example of such an application is dangerous goods tracking and tracing service offered by Qascom company [Qascom 2010]. Apart from tracing the hazardous load, the solution includes:

- tamper-detection module, which monitors whether the track has been accessed by any unauthorised parties,
- enhanced survivability of the system so that communication can be maintained with the headquarters even in case of accident or attack,
- authentication and association of driver with the load, so that only an authorised driver can drive the vehicle,
- enhanced privacy measures, which assure that confidential information on the load can be accessed only by authorised parties,
- enhanced survivability of the system in case of GPS signal interruptions and blockages.

As can be seen, even though the system is quite similar in operation to the usual tracking service, it requires enhanced survivability and privacy measures to make sure the load is handled in a safe manner.

Location-specific tolls and taxes

Location based services have also found their potential application in the area of billing and taxation. Since certain payments are dependent on the geographical context, e.g. distance covered, area of operation, information on vehicle's location could be used to adjust the height of payment accordingly [Steiniger et al. 2006]. For instance, London's congestion charge could potentially be based on the true time spent in the congestion charge zone. In such a manner, the height of the tax would better reflect the contribution of the vehicle to traffic congestion which would give the authorities a strong and fairer leverage in managing the road network.

Nonetheless, this utopian vision of 'more fair' taxes is disturbed by the privacy concerns. Constant monitoring and analysing data on vehicles' location, a concept potentially extendable to individuals, evokes with omnipresent and omniscient 'Big Brother-like' authorities. Furthermore, such data could potentially be used by companies to tailor advertisements to the preferences of users (which could be deduced from where they go) which people do not want in general [Wigan 2009]. It can be seen that location based services touch on very sensitive areas which may affect the path of their further development. As a result, to the author's best knowledge such solutions have not been introduced anywhere yet.

Geo-eco-driving

The concept of Geo-eco-driving is basically an extension to the idea of eco-driving which is set of driving behaviour that maximises the efficiency of vehicle operation and, as a result, minimises its negative environmental impact [ECODRIVEN 2006]. Geo-eco-driving is an upgraded version of that concept which makes use of the information on vehicle geographical position and electronic maps. This information, combined with constantly monitored driver behaviour, such as gearbox use, acceleration and braking techniques, are analysed and combined to provide advice on how the vehicle should be driven to achieve highest efficiency given the geographical context (hilly area, congested urban street, motorway).

As for now, the idea has not been applied very extensively although certain car companies have started to include that component in their offer. For instance, FIAT [FIAT 2010] offers its customers a service named ecoDrive by means of which onboard sensors and positioning unit monitor how a vehicle is driven and store that information on a USB stick. After finishing the journey, the stored information can be processed using special software available at FIAT's website to provide advice on how the driving style could be altered to become more fuel-efficient. The company also offers extension of the service for the fleets called ecoDrive Fleet, which allows simultaneous analysis of numerous vehicles and drivers.

ENVIRONMENTAL IMPACT OF THE LOCATION BASED SERVICES APPLICATION

As it has been shown, Location Based Services have already penetrated the segment of light goods vehicles and are also likely to increase their significance in the future. Nonetheless, the question remains if their contribution will be limited to the economic profitability of the vehicle operation, or whether also natural environment can gain. The discussion below explores the extent to which each of the aforementioned location based service can contribute to greater environmental friendliness of light goods vehicles in urban areas:

- **Real time navigation.** The environmental benefits resulting from real time navigation applied in LGV are such that the vehicles are routed in the most efficient manner, i.e. their fuel consumption is minimised subject to accomplishing a given set of deliveries. Real time navigation allows the drivers to operate in an unfamiliar with a risk of getting lost greatly reduced. As a result, risk of covering unnecessary distance (and of burning more fuel) is smaller [DfT 2009]. Yet a strict quantitative estimation of the strength of that link has not yet been fully established due to the fact that the sole routing equipment provides only potential to reduce the pollution. The actual use of it in real life context depends on a great deal of circumstances, among them driver's behaviour, which makes the area especially difficult to explore.
- **Dynamic fleet management.** In case of a dynamic fleet management, LGV are operated and scheduled as to maximise their profitability. On one hand, this is equivalent to saying that for a given task, the fuel efficiency is increased and therefore environmental cost is reduced [DfT 2009]. However, greater operational efficiency and reliability may lead to increased demand for such services and increased usage of LGVs. This, as already mentioned, has been one of the reasons behind the recent dynamic growth in LGV use. As a result, improved efficiency can be outweighed by increased fleet sizes resulting, paradoxically to some extent, in greater pollution [Zanni and Bristow 2010].
- **Freight tracking and monitoring**. The main environmental advantage for the LGV operation that can result from freight tracking and monitoring lies in a more optimal time-allocation of activities of parties involved in the. Since the load can be easily monitored at all times, logistics centre, fleet operator and final receiver can avoid making unnecessary trips resulting from unexpected changes in delivery time, LGV being broken down or any other events [DfT 2009].
- **Hazardous materials transport**. In this case it is the hazardous nature of the load transported by the LGVs that is a potential threat to the environment. The risk of that threat can be reduced through constant monitoring, avoidance of entering the environmentally sensitive areas or instantaneous response in case of an accident. An example of that is a recently developed MITRA (monitoring and intervention of transportation of dangerous goods) project which is essentially an extensive pan-European LBS allowing the authorities to track movement of hazardous materials. The system has recently successfully undergone field trials in Spain and France, and is expected to bring significant benefits in the area of hazmats handling [Planas et al. 2008].
- **Location-specific tolls and taxes**. In this case two aspects of potential contribution to the environmental friendliness needs to be considered. On one hand, electronic billing and taxation can reduce the need of vehicles to stop (e.g. on motorways) to pay the fee which, on the other hand, bring significant reductions in emissions [Kurke 2009]. On the other hand, location-specific billing can be used by the authorities to impose location-specific environmental taxation on the LGV [Ramstedt and Davidsson 2010]. Nonetheless, such solutions have not yet been introduced and the aforementioned privacy-related issues will possibly make them impossible to implement in the foreseeable future.
- **Geo-eco-driving.** From its strict definition eco-driving is oriented at maximising fuel efficiency of the car so. Since the geo-eco-driving is a very novel concept, not too much research on its effects have been conducted so far, not mentioning the potential environmental effects.

However, application of the eco-driving techniques alone are estimated to have a potential of reducing, on average, fuel consumption by 5-10% [ECODRIVEN 2006] which translates into similar decrease in air pollution generation. As a result it can be deduced that further augmentation of the techniques with the 'geo' component can bring even better efficiency.

As it can be seen, the LBS have a potential in making light goods vehicles more environmentally friendly in various ways. Nonetheless, there is a gap in the detailed knowledge regarding the strength of these relationships, thus reducing the ability to draw more complex inferences, e.g. what factors determine which LBS is chosen by the operators. Hopefully, more research in this area will be conducted in the near future so that the issue is better understood.

CONCLUSIONS

It has been explored throughout this paper to what extent the available and developed location based services can be applied to the light goods vehicle operation in order to reduce their negative impact on natural environment in urban areas. It has been shown that LGVs do contribute significantly to pollution of natural environment, especially in terms of air pollution, and that this trend is likely to continue. On the other hand, rapid evolution of the information and communication technologies have provided the operators with location based services which by making use of the combination of cutting edge technologies can provide tools to reduce the LGVs' burden on the environment. Of particular importance in doing so, as for now, are LBS related to real time navigation and dynamic fleet management which are widely applicable solutions in LGVs' operation. Freight monitoring and tracking, including hazardous materials transport, has also an environmental potential, but it would only affect either a small fraction of delivery cases, or a quite specific transport niche, not the LGV sector in general. Last but not least, location-specific tolls and taxes as well as geo-eco-driving, although having a significant potential, have not yet been implemented widely and therefore limited conclusions can be drawn in relation to these LBS as for now.

On the other hand, there remains a substantial gap in terms of the research oriented on the applicability of the LBS to LGV operation which also reduces the potential to look the problem from an environmental perspective. As this area seems very promising in light of the growing importance of both LGV and LBS, more specific and quantitative research would be desirable.

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USŁUGI LOKALIZACYJNE I TRANSPORT DOSTAWCZY W OBSZARACH ZURBANIZOWANYCH (UJĘCIE ŚRODOWISKOWE)

STRESZCZENIE. W artykule poddano rozważaniom problematykę operowania transportu dostawczego (LGV) w obszarach zurbanizowanych. W szczególności, poddane zostały analizie możliwości zastosowania usług lokalizacyjnych (LBS), wykorzystujących technologię bazującą na systemach telefonii komórkowej różnych generacji w zmniejszaniu negatywnego wpływu transportu dostawczego na środowisko naturalne. Dywagacje objęły usługi lokalizacyjne takie jak: nawigacja w czasie rzeczywistym, dynamiczne zarządzanie flotą transportową, śledzenie oraz monitorowanie frachtów, transport materiałów niebezpiecznych, opłaty i podatki związane z przemieszczaniem się środków transportu w obszarach miejskich, oraz techniki ekologicznego prowadzenia pojazdów (eco-driving). Aspekty te postrzegane są przez autora jako najbardziej istotne w redukowaniu poziomu emisji zanieczyszczeń pochodzących od transportu dostawczego. Z przeprowadzonych analiz opartych na aplikacjach konkretnych rozwiązań w systemie społeczno-gospodarczym miast wynika, że w omawianym kontekście ekologicznym usługami o największym znaczeniu są nawigacja w czasie rzeczywistym oraz dynamiczne zarządzanie flotą transportową. Śledzenie oraz monitorowanie frachtów, szczególnie o niebezpiecznych właściwościach zostało zidentyfikowane jako usługa o znaczącym wpływie, jednak istotnie ograniczonym ze względu na specyfikę sektora. Pozostałe czynniki - takie jak na przykład eco-driving, pomimo znaczącego niewątpliwie wpływu, nie pozwalają na wysnucie wiążących wniosków ze względu na ograniczone ich stosowanie. W podsumowaniu wskazano na niewystarczającą ilość badań dotyczących omawianej problematyki i zasugerowano ich dalsze kierunki.

Słowa kluczowe: usługi lokalizacyjne, obszary zurbanizowane, przyjazność środowiskowa, transport dostawczy.

TELEMATISCHE DIENSTLEISTUNGEN UND DER ZULIEFERER-TRANSPORT IN URBANISIERTEN BALLUNGSGEBIETEN (IN UMWELTBEZOGENER HINSICHT)

ZUSAMMENFASSUNG. Im Artikel wurde die Problematik des Einsatzes von Zulieferungs-Transportwagen in urbanisierten Ballungsgebieten in eine tiefeingehende Erwägung gezogen. Insbesondere wurden Möglichkeiten einer In-Anspruch-Nahme von telematischen Dienstleistungen (LBS), welche auf Technologien mobiler Tele-Systeme unterschiedlicher Generationen basieren, für eine Verringerung des negativen Einflusses des Zulieferer-Transportes auf die Umwelt einer Analyse unterzogen. Die betreffenden Erwägungen umfassten folgende telematische Dienstleistungen, wie: Echtzeit-Navigation, dynamische Verwaltung von Fuhrparken, Tracking und Überwachung von Transportfrachten, Transporten von Gefahrgütern, die mit Transportmittel-Verkehr in Ballungsgebieten verbundenen Gebühren und Steuern, sowie Techniken für umweltfreundliches Führen von Transport-Fahrzeugen (Eco-Driving). Die genannten Aspekte werden vom Verfasser als meist relevante Einflussfaktoren bei Reduzierung des Niveaus der vom Zulieferer-Transport verursachten Abgase wahrgenommen. Aus den auf die Anwendungen konkreter Lösungen innerhalb der städtischen, sozial-wirtschaftlichen Systeme gestützten Analysen geht eindeutig hervor, dass im betreffenden Kontext die Echtzeit-Navigation und die dynamische Verwaltung von Transport-Fuhrparken die größte Bedeutung haben. Verfolgung und Monitoring von Frachten, insbesondere von Gefahrgut-Frachten wurden als Dienstleistungen von einem bedeutenden, allerdings in Hinsicht auf die Spezifik des Sektors wesentlich eingeschränkten Einfluss identifiziert. Die anderen Einflussfaktoren, wie z. B. Eco-Driving, erlauben jedoch, trotz einer zweifellos gewichtigen Auswirkung keine wegen der begrenzten Anwendbarkeit bindenden Schlüsse zu ziehen. Im Fazit wurde auf die unzureichende Anzahl der dies bezüglichen Forschungen, sowie auf deren mögliche Ausrichtung hingewiesen.

Codewörter: telematische Dienstleistungen, urbanisierte Ballungsgebiete, Umweltfreundlichkeit, Zulieferer-transport.

Zbyszko Pawlak
Poznan School of Logistics
ul.Estkowskiego 6
61-755 Poznań, Poland
e-mail: zbyszko.pawlak@wsl.com.pl