



IMPLEMENTATION OF THE CONCEPT OF GREEN LOGISTICS REFFERING TO IT APPLICATIONS FOR ROAD FREIGHT TRANSPORT ENTERPRISES

Aidas Vasilis Vasiliauskas¹, Virgilija Zinkevičiūtė², Eglė Šimonytė³

¹Vilnius Gediminas Technical University, Transport Research Institute, Plytinės g. 27, LT-10105 Vilnius, Lithuania

²Vilnius Business College, Kalvarijų g. 125, LT-08221 Vilnius, Lithuania

³Vilnius Gediminas Technical University, Transport Management Department, Plytinės g. 27, LT-10105 Vilnius, Lithuania
E-mails: ¹aidasv@vgtu.lt; ²virgilija@kolegija.lt (corresponding author); ³egle.simonyte@vgtu.lt

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Abstract. The article examines a scientific and practical problem concerning the ability to implement a concept of green logistics with reference to IT applications for Lithuanian road freight transport enterprises. A scientific discussion develops the relation between the concept of green logistics and the principles of sustainable development. The paper analyses the main problems of green logistics and IT employment in the sector of Lithuanian road freight transport enterprises and focuses on the elaborated model representing a set of IT applications necessary to achieve the goals of green logistics in the road freight transport enterprise.

Keywords: sustainable development, green logistics, road freight transport, transport enterprise, IT applications, strategy implementation.

JEL Classification: O14, L91, Q01; R41

ŽALIOSIOS LOGISTIKOS KONCEPCIJOS TAIKYMAS PASITELKIANČIŲ IT PRIETAIKAS KELIŲ TRANSPORTO ĮMONĖSE

Aidas Vasilis Vasiliauskas¹, Virgilija Zinkevičiūtė², Eglė Šimonytė³

¹Vilniaus Gedimino technikos universitetas, Transporto institutas, Plytinės g. 27, LT-10105 Vilnius, Lietuva

²Vilniaus verslo kolegija, Kalvarijų g. 125, LT-08221 Vilnius, Lietuva

³Vilniaus Gedimino technikos universitetas, Transporto vadybos katedra, Plytinės g. 27, LT-10105 Vilnius, Lietuva
El. paštas: ¹aidasv@vgtu.lt; ²virgilija@kolegija.lt; ³egle.simonyte@vgtu.lt

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Santrauka. Straipsnyje nagrinėjama Lietuvos kelių transporto įmonių galimybės diegti žaliosios logistikos koncepciją, naudojant IT prietaikas, mokslinė ir praktinė problematika. Pirmiausia atliekama ryšį tarp darniosios plėtros principų ir žaliosios logistikos koncepcijos gvildenančios mokslinės literatūros analizė. Atskleidžiama esama žaliosios logistikos koncepcijos ir IT prietaikų naudojimo lygio Lietuvos kelių transporto įmonėse situacija ir problemos. Galiausiai, remiantis mokslinėmis teorijomis ir atlikta apklausa bei ekspertiniu vertinimu, siūlomas rinkinys IT prietaikų, kurios tampa modelio, skirto žaliosios logistikos strategijai kelių transporto įmonėje įgyvendinti, sudėtine dalimi.

Reikšminiai žodžiai: darnioji plėtra, žalioji logistika, krovininis kelių transportas, transporto įmonė, IT prietaikos, strategijos įgyvendinimas.

Introduction

One of the main goals of the EU common transport policy is the establishment of an environmentally-friendly, efficient, competitive and safe transport system. According to the provisions contained in the strategic EU documents, the Member States of the European Union are obliged to increase the efficiency of their transport systems through the minimization of its negative impact on the environment, an increase in safety on the roads and the creation of favourable conditions for labour (2010). Therefore, the implementation of the concept of green logistics gains particular actuality all over the union.

The concept of green logistics is strongly interrelated with the policy on sustainable development in the transport sector. Green logistics is a form of logistics which expected to be not only environmentally but often socially friendly and economically functional (McKinnon *et al.* 2012). The importance of the concept of green logistics is mentioned on global, regional and national levels; still, the sector of business is recognized to be the one responsible for implementing the principles and initiatives of green logistics. Some scientists suggest that the application of the principles of private public partnership and involvement of all interested parties, however, would be more beneficial (Meidutė, Paliulis 2011). Nevertheless, the implementation of green logistics is treated as an ability of the enterprise to run its activity (even to increase its competitive ability) according to economic, social and environmental factors (Balkytė, Tvaronavičienė 2010; Bagdonienė *et al.* 2009).

One of the most efficient tools for increasing the competitiveness of the transport system is Intelligent Transport Systems (ITS), including its certain applications (Jakubauskas 2012). ITS are advanced applications that enable various users to make safer, more coordinated and more efficient use of a transport network.

According to the official statistics of Lithuania (Transport and Communications 2012, 2011, 2010), the dominant mode of transport (counting the volumes of carried freight and an impact on national economy) is road freight transport. Official statistics also proves, that at the same time road freight transport is the most dangerous, most pollutant and most energy consuming mode of transportation. On the other hand, practice shows that enterprises representing this mode of transportation are the most flexible and adapt new technologies and innovations faster and in higher volumes than the others.

Thus, the questions like “*How do the enterprises of Lithuanian road freight transport sector understand the concept of green logistics?*”, “*What benefits can this concept provide to the enterprise?*” and “*How could the introduction of IT applications increase the competitiveness and image of these enterprises?*” gain particular interest.

The subject of research is the problems and possibilities of implementing the concept of green logistics referring to IT applications in road transport enterprises in Lithuania.

The goal of the conducted research is to provide the results of certain investigations dedicated to the examination of the current situation concerning the implementation of the concept of green logistics in the sector of road transport enterprises.

The basic methods for research include the analysis and synthesis of scientific literature, legal acts and statistic data, a survey of the problems encountered in the road transport sector as well as an expert evaluation of the proposed model.

1. The issues of implementing the concept of green logistics

Green logistics can be defined as all attempts to minimize an ecological impact of logistics activities. The analysis of many scientific sources of foreign and Lithuanian scientists (McKinnon *et al.* 2012; Kutkaitis, Župerkienė 2011; McKinnon, Kreie 2010; Emmet, Sood 2010; Palmer, Piecyk 2010, Guochuan 2010; Sbihi, Eglese 2010; Cherrett *et al.* 2009; Bagdonienė *et al.* 2009; Monnet 2008; Srivastava 2007; Rodrigue *et al.* 2001) proves that the concept of green logistics has gained more and more attention during recent years. Also, it proves that the concept of green logistics is related to the definition of sustainable development.

Scientists state that green logistics is

1. a common logistics system based on efficient energy consumption and less environment harming while increasing labour efficiency and competitiveness (Kutkaitis, Župerkienė 2011);
2. a logistics system created in accordance to human needs and interests and showing trends towards the strategy for implementing sustainable development (Guochuan 2010);
3. an input based on organizing actions focused on creating efficient energy consuming and a less environment polluting system of logistics (Srivastava 2007);
4. an environmentally friendly and efficient distribution system (Rodrigue *et al.* 2001).

According to Čepinskis and Masteika (2011), green logistics encompasses 4 implementation fields: distribution, energy consumption, manufacturing (production) and raw material mining.

Taking into account that the concept of green logistics is related to sustainable development, it can be stated that the concept is also based on three equivalent levels: economic, ecologic and social (see Fig. 1). This proves that the implementation of the concept of green logistics in a particular enterprise should be supported by the principles of economic, ecologic and social responsibility. According to Turky, Funda (2011), Šimanskienė, Kutkaičius (2009), Čiegis, Grunda (2007), the further provided scheme shows the process of implementing the concept of green logistics in a particular enterprise.

The goals provided on every level are of different efficiency and importance, and therefore have a varying impact on implementing the concept of green logistics. Such situation allows making a conclusion that every single enterprise should create its own strategy for implementing such concept, thus considering different internal and external factors affecting its performance. It also should be noted that the implementation of the concept of green logistics is based on initiative and voluntary principles.

Therefore, the process of implementing the concept of green logistics is complicated and multiple, and requires a close collaboration between state entities, society and business.

Sarkis, Meade and Talluri (2004) distinguish particular steps of implementing the concept of green logistics:

1. The adoption of political decisions according to environmental impact.
2. The continual development of high technologies (business field takes a leading role in technology development).
3. Investment and integration (integration of necessary logistics functions in order to assure efficient distribution).
4. The efficient management and policy of the organization based on the principles of green logistics (establishment of business processes in accordance with economic, social and environmental factors).

Murphy and Poist (2003) present particular actions to be taken on the enterprise level to implement the concept of green logistics:

- reengineering the components of logistics systems in accordance with the environment and social factors;
- the rejection of services provided by suppliers taking no care about environmental problems;

- training the staff;
- collaboration with governmental institutions;
- public reports about the initiative and success of the company in the field of environment protection;
- the audit of environment control;
- collaboration with foreign countries in the field of environment protection;
- promoting social responsibility among the employers of the enterprise.

The action of implementing the concept of green logistics begins with reengineering the logistics system of the company. Recent findings suggest that such reengineering can be quite efficient when certain IT applications are implemented. This is particularly the case of the road transport sector. Road freight carriers are highly criticized for causing various externalities. As concern for the environment rises, enterprises must take more care of logistics activities associated with climate change, air pollution and accidents. The deployment of IT applications can contribute to positive changes in the field of the above introduced problem.

2. Possibilities of IT applications

Transport activity in various sources of scientific literature is described as one of the main functions of logistics. Therefore, a quite natural conclusion can be made that in case a better overall transport system is created and the problems of its efficiency are solved on the national and global level, the more efficient transport services can be created and provided.

The application of traditional means of solving general transport problems often is too expensive and inefficient. Meanwhile, intelligent transport systems (ITS) or some of its applications can be treated as a new step of transport system evolution that allows solving different types of problems

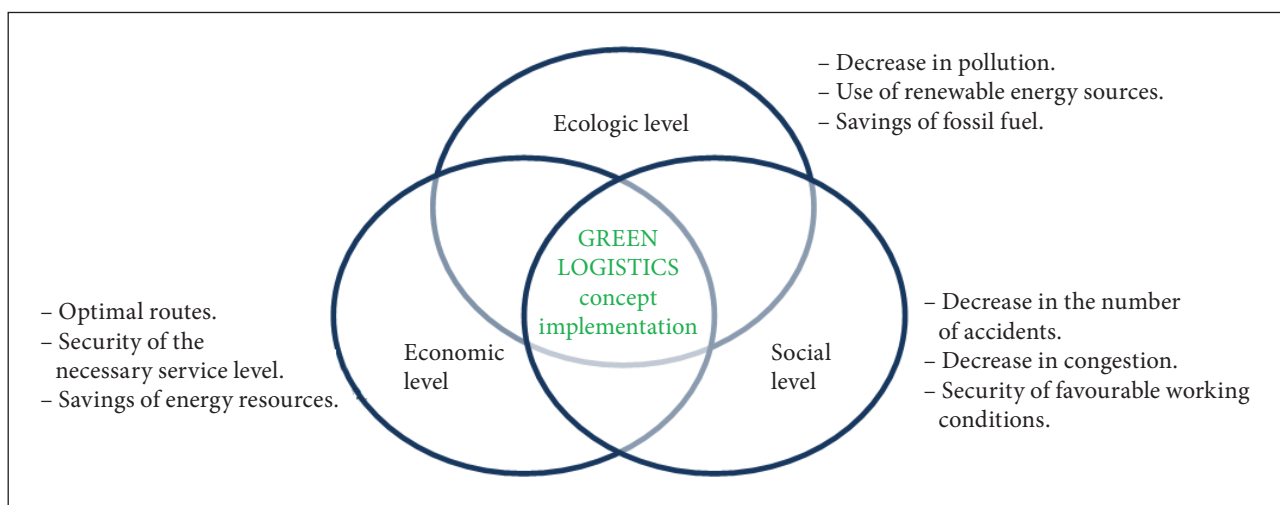


Fig. 1. Key goals for implementing the concept of green logistics

on different levels in different transport sectors. ITS or some of its applications are also one of the tools that allows implementing the concept of green logistics in reality since they assure efficient consumption, reduce a negative impact of transport on the surrounding environment, increase safety and decrease the number of accidents on the roads (Jarašūnienė 2008). These systems are often understood as a common application of integrated connections, control and information processing technologies in the transport system. This allows to conclude, that ITS can be applied to the management of transport flows, the creation of more favourable driving conditions, an increase in safety and a decrease in the number of transport accidents. These systems increase the productivity of the transport sector, save human lives, money and energy resources (Jakubauskas 2012, Jarašūnienė 2008). They provide a possibility of reducing a negative impact on the surrounding environment, controlling transport networks and allowing choosing optimal travel routes. The analysis of the best practice of foreign countries has revealed that the state or separate enterprise often choose IT applications as a tool for implementing the concept of green logistics in practice. The most frequently used applications include cargo trace and tracking systems, distribution systems, service reservation systems, route planning systems, fuel consumption control systems, driver's work-time control systems, fee and toll collection systems, integrated car safety systems, process real time control and management systems.

A conclusion that the application of the above mentioned tools allows reaching the main goals of green logistics at different levels can be made. The employed instruments reduce expenditure on enterprise activities and allow solving social as well as ecological problems.

3. Problems of implementing the concept of green logistics in Lithuanian road freight transport enterprises

At present, the common transport policy of the EU pays close attention to sustainable development. The problem is that policy documents provide only the common aspects of sustainable development in the field of transportation and stress the importance of applying new technologies and collaboration between different involved subjects. The outcome of such an approach is different priorities given for green logistics in different countries. These priorities vary according to the economic situation, historical and cultural heritage, climate conditions and preferences in national policies. However, a common notion that, despite the above mentioned differences, all EU Member States are concerned about road freight transport can be made.

The main directions of Lithuanian transport policy are adequate to those provided by the EU (Jakubauskas 2012). Nevertheless, according to the outcomes of the study on

the possibilities of using IT applications in Lithuania conducted in 2011, the level of implementing these tools in the transport sector is quite modest.

At the same time, official statistics in Lithuania indicate that road transport is a mode of transport that reached the highest growth rates during recent years. As mentioned earlier, this mode is often criticized due to a negative impact on the economy, society and environment (Transport and Communications 2012, 2011, 2010).

Therefore, giving ITS strategic priorities towards a solution to solve the problems of Lithuanian road freight transport would be logical and justified. However, the problem is that Lithuania still experiences a traditional attitude towards the development of transport infrastructure, when the majority of investments are given to the development and maintenance of roads. Meanwhile, the projects related to the implementation of IT applications, which seemed to be more reasonable, are found very seldom, though the experience of foreign countries proves them having stronger economic effect than the development of hard infrastructure.

Another problematic point is a lack of practical and theoretical models dedicated particularly to road freight transport enterprises so that to implement the concept of green logistics that would satisfy not only economic but also ecological and social needs of the society.

There are no exact tools and approaches to implementing the concept of green logistics, especially taking into account possibilities provided by IT applications. Road freight transport enterprises face a lack of clear guidelines that would be helpful in making a decision on purposive investments into the exact projects and tools in order to assure the efficiency of the performance of those enterprises in the context of green logistics.

4. The common model for implementing the concept of green logistics at the enterprise level

In order to implement the concept of green logistics in reality, every particular enterprise needs a clear strategy model by applying which the enterprise would be able to distribute necessary investments in the exact tools that seem to be more efficient.

As mentioned above, the process of implementing the concept of green logistics should follow all three strategic directions (social, economic and ecologic). The implementation of this concept is primarily determined by a decision made by the company's executives. The decision can be reached under the impact of all interested parties as well as taking into account some internal and external factors. All these aspects are depicted in the theoretical model for implementing the concept of green logistics on the enterprise level (see Fig. 2).

The model distinguishes the main factors affecting the implementation of the concept of green logistics, the process

of implementing the strategy and benefits that should be reached by applying the concept of green logistics.

As have been discussed, the strategic process of implementing the concept of green logistics consists of 5 steps (stages) the enterprise should follow in a particular sequence. The first two steps are associated with preparation for implementing the strategy. They encompass a strategic analysis of implementing the concept and the evaluation of activity fields and strategic decisions. These steps are necessary to successfully choose the necessary fields of activity that would be useful in the context of the concept. The third step requires IT applications that will help in reaching the main goals of implementing the concept of green logistics. The last two steps cover the implementation of the strategy itself as well as monitoring and evaluation of the achievements.

The process of implementing the concept of green logistics is based on the initiative and voluntary basis of the enterprise. However, an important point is that the decision on the highest

level of the company’s management should be taken only when clear understanding about the concept of green logistics exists and benefits as well as commitments are realised.

5. Elaborated model for achieving the goals of green logistics in the road freight transport enterprise

In order to find out the possibility of applying the model discussed in the previous chapter in the enterprises of the road freight transport sector, a necessary survey was conducted. The object of the survey was Lithuanian road freight transport carriers (for the period 2011–2012, response was provided from 82 companies in total). The basic aim of the survey is to evaluate the possibility of implementing the concept of green logistics in Lithuanian road freight transport companies as well as to distinguish the most suitable IT applications to assuring such implementation.

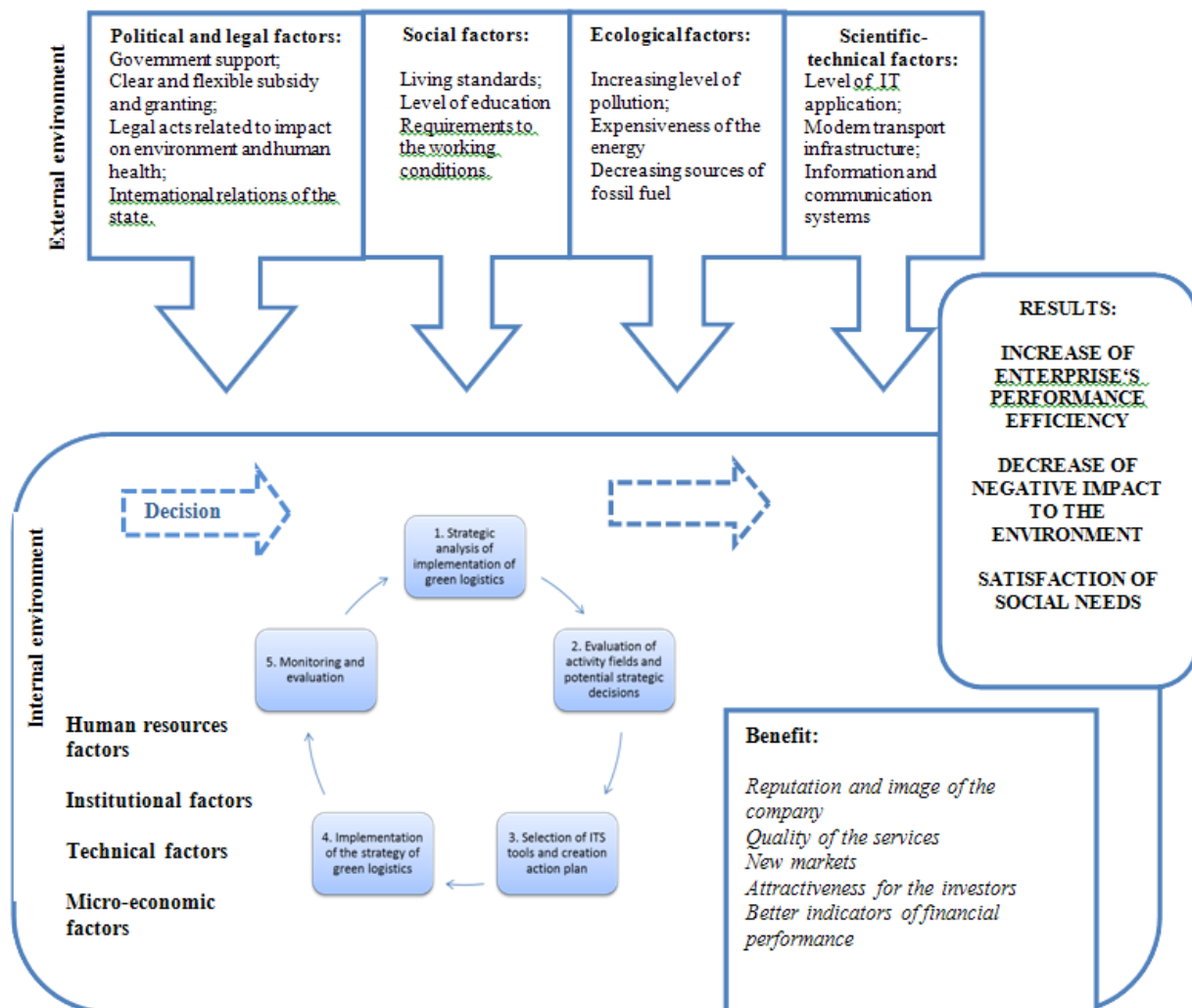


Fig. 2. Model for implementing the concept of green logistics on the enterprise level

In order to reach the above mentioned goal, the following tasks for the survey were set:

1. To establish the level of green logistics and IT applications in the road freight transport sector.
2. With reference to the results of the survey, to create a revised model for achieving the goals of green logistics employing IT applications in the road freight transport sector.
3. On the basis of the expert's opinion, to determine the suitability of the revised model and main factors in the successful implementation of the model.

The conducted survey and processing the obtained results allowed formulating the revised model for implementing the concept of green logistics applying IT in road freight transport companies. The goals distinguished in this model cover all levels of implementing the concept of green logistics:

- economic level (decrease in fuel costs, improvement in the level of service, time savings);
- ecologic level (decrease in pollution);
- social level (decrease in the number of road accidents and level of congestion).

In order to discover whether the chosen IT application is suitable for implementing the concept of green logistics

on the enterprise level and what actions would assure the efficiency of implementation, the expertise of the model was conducted. The model containing a particular attendant questionnaire was provided for the experts (11 in total) working or having huge experience in the field of transport and ITS.

8 of 11 experts agreed on the fact that the model was suitable while the remaining 3 suggested that the model needed some minor refinement. Also, the experts proposed some changes in the initial set of IT applications chosen as the main tools for the successful implementation of green logistics on the enterprise level. Moreover, all experts indicated that the main factors for the successful implementation of the concept of green logistics in the road transport enterprise would be the competence of the enterprise, the ability of chosen IT applications and exchanging information (ability to properly use the acquired data inside and outside the enterprise). Support provided by the EU and close cooperation between all interested parties were also accepted as crucial factors.

According to suggestions and recommendations made by the experts, the revised model has been developed and gained the form shown in Fig. 3. The displayed model is more suitable for implementing the concept of green logistics applying IT in Lithuanian road freight transport enterprises.

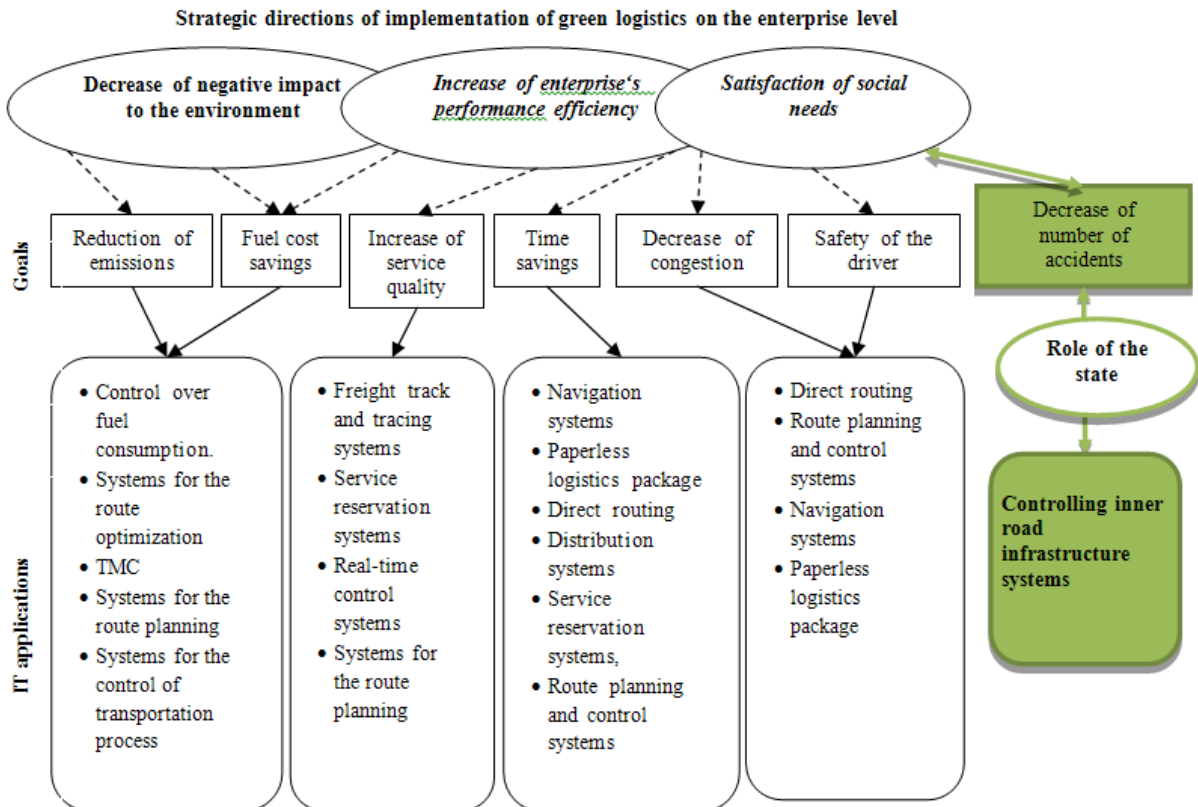


Fig. 3. Elaborated model for achieving the goals of green logistics in the road freight transport enterprise

The successful implementation of the concept of green logistics in Lithuanian road freight transport enterprises would help Lithuania with making input into achieving the common strategic goals of the EU. It is expected that the model presented in this article would allow transport enterprises choosing the correct path for implementing the concept of green logistics and encourage them to follow it. Also, it is supposed that transport enterprises will realize the practical benefit of implementing such strategy and will not employ single IT applications directed towards an increase in economic indicators, but rather the complex set of IT applications dedicated to the development of all three composite levels of green logistics.

Conclusions

1. The analysis of sources presenting different scientific literature has revealed that the term of green logistics is associated with the term of sustainable development in logistics. The concept of green logistics is based on 3 equivalent levels – economic, ecologic and social.
2. IT and its particular applications can be treated as a new step of transport system evolution that allows solving problems of different types and levels in different transport sectors. IT application is also one of the tools that allow implementing the concept of green logistics in reality.
3. One of the main strategic issues in modern-day common European transport policy is the creation of a more efficient, safe and environmentally-friendly transport system. Therefore, much is done in the sector of road freight transport, since this particular field is recognized as the harmful one. On the other hand, it is also accepted as the most flexible and promising area for reaching decisions based on the latest innovative technologies.
4. Despite all attention given to the sector of road freight transport, there are no exact models and recommendations for implementing the concept of green logistics, especially taking into account possibilities provided by IT applications.
5. Considering all above mentioned circumstances and bearing in mind the necessity of increasing the competitiveness of Lithuanian enterprises working in the sector of road freight transport, the authors of this article provide a model (well-received by the experts of transport and ITS fields) for implementing the concept of green logistics. The introduced example shows that a transport enterprise, when referring to a necessary set of IT applications, can reach many benefits – from the goals of green logistics to an increase in its image and reputation,

enhancing the quality of services, penetration into new markets, reaching better performance and becoming more attractive to investors.

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Aidas VASILIS VASILIAUSKAS. Assoc. Prof., Dr of technological sciences at the Department of Transport Management and a scientist of Transport Research Institute, Vilnius Gediminas Technical University. Research interests: supply chain management, transportation and warehousing processes.

Virgilija ZINKEVIČIŪTĖ. Dr of social sciences, Deputy Director of Academic Affairs, Vilnius Business College. Research interests: strategic decisions, strategy, quality management, sustainable development.

Eglė ŠIMONYTĖ. MA in Transport and Logistics, Transport Management Department, Vilnius Gediminas Technical University. Research interests: ITS, green logistics.