Logistics

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Logistics means comprehensive management of all activities necessary to move products through the supply chain. For a typical product this chain extends from raw material extraction through the various stages of production and distribution systems to the point of use and the associated feedback loop. The main objective of logistics is the coordination of logistics activities so that the minimum cost of meeting the requirements of customers.

1 Introduction

In the past, the costs of achieving the logistics objectives were expressed only in financial or economic terms, but today companies need due to growing concerns about environmental pollution take into account climate change, air pollution, noise, accidents, etc. The primary objective of logistic activities, therefore, is not only economical, but the balance between economic, environmental and social objectives.

A lot about logistics as a part of supply chains and their management has already been written in this chapter; therefore, the following subchapters will highlight two of the main subfields of logistics today – green logistics and city logistics.

2 Green Logistics

The word "green" has become a "code" for a series of environmental doubts and is largely considered positive / and has mostly positive connotations. It means compatibility with the environment and is, like logistics, something that is beneficial. **When these two words: green and logistics are combined, we obtain an environmentally friendly and efficient system**. This term has by itself a huge demand and is seen through the eyes of many as a very suitable and convenient, but when it explores the concept and its features come increasingly to the fore a number of paradoxes and contradictions, from which it follows that the functions of this system are many more complex than expected at first glance.

The word "green" appeared for the first time in the transport industry in the late 80's and early 90's of last century. It developed from a greater awareness of environmental problems and increased its importance when we started talking about the ozone hole, global warming and acid rain. The establishment of the World Association for Environment and Development as a result of the international events gave great seal to "green" issues in the political and economic environment.

Through the logistics industry an interest in the environment has certainly proved to be most certainly, even in terms of exploration of new market opportunities. If, on the one hand, traditional logistics investigate how to organize the distribution, transport, warehousing, packaging, management of stock etc. from the producer to the consumer, on the other hand it puts environmental issues and is at the same time focused upon the evolving marketplace of recycling and disposal, which directs it to fully new sector, i.e. reverse logistics, which handle the waste generated during transport, and recovery of materials used for once. Reverse logistics is a widely used term, although some authors mention other terms such as return distribution (Krumwiede & Sheu, 2002), opposite emerging logistics, and green logistics. Description of green logistics in the context of the concept of relief logistics represents only a part of the environmental friendly logistics, which in a broader sense also called green logistics.

Green logistics and related topics have recently become highly interesting and in most cases also dictate the strategies of countries and companies. Therefore, the questions that lies behind the concepts of green logistics and green supply chain, why "being sustainable" is so important, and lately also popular, which are the marginal areas meeting the green logistics and which are good practices in green logistics is increasingly present in our daily lives etc. are increasingly present in our daily lives.

Exploring the field of green logistics is the subject of a number of the world's scientists who study and write about this phenomenon (Nikoličič and Lazič (2006), Lowe (2002), and others). We give some definitions: Nikoličić and Lazić (2006) present the concept of green logistics as to efficiently carry out all duties of logistics with pollution-free environment. Smith (2010) understands green logistics as a form of logistics, which is friendly to the environment, society and economy at the same time. Beker and Stanivuković (2007) consider green logistics as the area which minimizes the negative impact of logistics activities on the environment to a maximum, also its purpose is to reduce energy consumption (energy consumption has a negative impact on the environment, in particular, it shows in the combustion of fossil fuels), and it aims to eliminate (reduce) the use of unwanted, environmentally unfriendly materials. Lowe (2002) represents the green logistics as logistics operations, carried out within the framework of the system in the presence of a number of environmental pressures, such as traffic congestion, air pollution, reduced fuel consumption, and waste, which has a major impact on the political and business decisions. Arlbjørn and Jahre (2008) see green logistics as a combination of logistics and environmental areas. This approach of logistics expands the traditional view of logistics in two views. First says that logistics covers all parts of the supply chain, from raw material extraction through manufacturing and distribution to recycling, and other forms of waste disposal. Second view says that logistics covers improved measures, such as better planning and coordination of the logistics system, which can have positive impact on the economy of the system (supply chain) and, consequently, a smaller negative impact on the environment. Cetinkaya (2009) represents green logistics as a complete transformation of logistics strategies, structures, processes and systems in enterprises and business networks, with the aim to create environmentally friendly and efficient logistics processes. The essence of green logistics is the conjunction between economy and ecology. Lee and Klassen (2008) consider that green logistics or green supply chain can be defined as a plan and activities of a company / organization with the aim of integrating environmental issues in the supply chain and, consequently improving the environmental awareness of both suppliers and customers. Sills (2010) explains that green **supply chain means the integration of environmental problems directly in logistics or supply chain, including product design, product selection, manufacturing techniques, and delivering the final product to the consumer, but also includes managing the product at the end of its lifetime.** Green supply chain helps to reduce the environmental load of the atmosphere, looking for cheaper suppliers, while attempting to reduce the prices at the producer reduces the cost to the consumer and provides for reduced consumption of resources by the benefits of modern society.

Green logistics in numbers

A recent survey (McKinsey, 2008) showed that strategy and verbiage about the green, environmentally friendly policies (on green supply (logistics) chain) in most companies have moved forward against acts. The study, which included more than 2,000 global companies in the U.S., showed that 73 % of them agree that climate change is an important factor, but only 23 % of them actually take into account when formulating their strategies.

A similar study was conducted in 2013 at the Faculty of Logistics, where the sample contains around 120 Slovenian companies and the analysis of the collected data found that in Slovenia the share of companies who believe that the topic of climate change is very important, is 80 %. Companies that integrate this topic in their strategies through measurable goals represent only the share of 27 %.

Today there is no longer a question of whether the logistics industry in supply chains should show a "green face". The pressure in this direction increases with the number of institutions and other subjects, and therefore changing all the articles and sectors in the economy in order to maximize contribute to the conservation of the environment. Megatrend - "green logistics" continues to grow from year to year, but the forecasts can recognize that the word "green" is slowly fading and fused with traditional - classic logistics and become invisible and mandatory part of the logistics activities.

The purpose of logistics is to reduce costs, save time, increase reliability and availability. The strategy of costs is often directly in conflict with the protection of the environment. Corporations involved in the physical distribution of goods are very sympathetic to the strategy, which allows them to reduce haulage costs in the competitive environment. Cost reduction strategies (cost-saving) carried out under the auspices of logistics operators are often incompatible with environmental reflections. Environmental costs are often external, which means that users are aware of the benefits of logistics, but the environment assumed a wide range of burdens and costs. Society (in general) and many individuals find it difficult to come to terms with these costs and pressure on the government with foreign institutions and regulations increasing more and more, which includes greater environmental observance in their activities.

How green supply chains really are?

Due to increased concerns about environmental pollution, companies must take into account climate change, air pollution, noise and accidents that are caused only due to these factors. Green logistics aims at studying the phenomena arising from pollution, as well as studying methods of reducing the impact on the environment. **Environmental protection is most affected by particular three elements of logistics, namely (packaging), transport (air and water pollution, noise) and storage (storage space).** Green logistics therefore aims to achieve a sustainable balance between economic, environmental and social objectives.

In short, we must invest in transportation design strategies that are more effective and more environmentally friendly, such as the consolidation of the distribution, the introduction of innovative ways of distribution (Milk - run mode), IT-based method of distribution planning, development and introduction of new transport vehicles, etc. (Jonsson, 2008).

Environmental costs are often external and represent a wide range of burdens and costs contractors and users of logistics services are not willing to pay. Society (in general) and many individuals find it difficult to come to terms with these disregarded external costs. Therefore, the pressure increases by government institutions as well as by foreign institutions to fully integrate environmental costs into account in the cost of operations.

Green logistics in the future

Currently, the situation in the world is such that the objective "Green logistics" is still very far away. The only exception is the reverse logistics, which has opened up new market opportunities associated with waste disposal and recycling, which is definitely a significant step, but still only a secondary contribution of logistics to protect the environment, while the direct impact (on the environment) is still somewhere on the side. There are environmental benefits resulting from a fairly direct transfer.

Transport industry itself does not constitute a "green face", certainly in the literary sense reverse logistics adds a lot to the road load. Producers and domestic producers of waste are those that achieve environmental trust.

There is no question if the logistics industry will show "green face". Pressure increases with the number of directorates, which changed all the articles and sectors in the economy in order to maximize contribute to a greater awareness for a better environment. Three scenarios were developed and discussed:

- Approach "top-down", where "green" is exposed in the logistics industry, according to government laws
- Approach is "bottom-up", where improvements are coming for the environment directly from the industry itself;
- A simple compromise between government and industry.

The first method takes the example of law enforcement, because the government would compel companies to "green business". Therefore, this approach is extremely unpopular. State descriptions and laws is direct, clear and strictly defined in the Act to improve the environment. In this case, it is indispensable to arrange, for example, "Cost-benefit" analysis, which includes the cost of repudiating the damage caused by poor environmental management. In the European Union there is a growing interest in paying, or rather, deal with the damage that we have over the years caused to the environment or nature, thereby harming ourselves. The European Union does not appear to matter if it will lead to an increase in prices of logistics services.

Even if the first approach seems like the only plausible, second approach also has certain advantages. This approach is extremely popular with producers, who are already producing environmentally friendly materials. Because many companies precisely see their business opportunity, therefore, in the production of environmentally friendly fuels in cars, heating, construction...

Best of all, it is probably the third approach, because it can all be solved with a good compromise. Practice management and control standards through certain certificates have proven to be very effective. Thus, the State would only verify who is certified for quality, so who produce for themselves, for their own benefit and at the same time keep an eye on the environment.

Efforts to protect the environment in which we live and we also depend on, have become the main theme of our stay. Only now, when we set up huge shopping centres, the most advanced factories, warehouses and businesses, we have become aware of what is happening around us. Every day we see road closures, we have witnessed accidents in the freight every day, we drive alone in our car to work, when we could go on a train or bus ... How much emission there go in the air due to the logistics activities? Immediately afterwards appears another big question: where to start? And the hardest is the answer: at the very beginning of pollution. Green logistics is just one of the good guidelines.

Information technology in the "green" logistics – »Green through IT»

Information technology (IT) open wide horizons optimization for industry and logistics. Often only allow IT to make logistics processes effective and flexible. First of all, it concerns the use of resources according to the needs.

A recent study «SMART 2020" conducted by a non-profit organization «The Climate Group», thanks to the support of new information and communication technologies to 2020 can reduce carbon dioxide (CO_2) emissions worldwide by 15 percent and save on energy of 600 billion euros. Industry association BITKOM notes secondary effects, due to which "smart" IT will save five times more carbon dioxide than is required for the implementation of these technologies.

However, this does not mean that the software becomes "green". Today it is necessary to specify an expression: it must designate such IT solutions that enable businesses to save energy and resources by optimizing their use in industrial processes. The software cannot be green; it allows to implement green solutions. «Green through IT», green IT solutions thanks - this is the mission of the intelligent, forward-looking logistics software.

Green solutions - using PSIwms

Warehouse management system with support for Multisite - such as software product class Premium PSIwms, - provide, for example, the management of interaction processes that span multiple warehouses, combined with intelligent resource management. Thanks to the "intelligent" approach, the software provides an optimal use and saving of resources, important and valuable in terms of intra-logistics: time, space, staff, energy and materials.

Green solutions - using PSItms

When managing a fleet of vehicles, transport planning and organization of flights, such systems transport control, such as, PSItms, help to make better use of transport, to avoid empty runs and understaffed transport. This reduces mileage, CO_2 emissions and transport costs. Software forms the basis for optimizing the use of resources and reduce the burden on the environment.

Green solutions - using PSIglobal

Integrated planning and control system PSIglobal designed for display, analysis, management and optimization of multi-stage, multi-modal logistics networks. PSIglobal - the software class Premium, designed for continuous monitoring and analysis of logistics processes of value creation and expressly provides functions to optimize environmental parameters. By using the definition of costs and emissions of harmful substances or multimodal optimization of supply chains can be associated with aspects of costs and services with environmental criteria (eg. consistency and reduced emissions) and to achieve optimal proportions depending on the desired conditions and parameters.

The software offers solutions to economic problems in the framework of modern business strategies. As these examples demonstrate, the responsible software developers are on the market standard products with a modular structure and scalable, providing enterprises not only maximum security of investment and flexibility. Thanks to innovative methods of resource management such decisions also allow to implement the principles of green logistics at all levels, from in-plant optimization to improve the interaction between different points and enterprises, as well as the design and planning of the supply chain. Thus, the mission of intelligent logistics software, future-oriented and forms the basis for the program and sustainable logistics solutions - not «Green IT», and «Green through IT». (Albrecht, 2011)

Carbon Footprint

Carbon footprint is a term that is used when we want to check the amount of CO2 and other GHG emissions for which they are responsible, either an individual or a company or organization.

We can calculate the carbon footprint of activities, events and products, and individuals. It is important to realize that the calculation of the carbon footprint is just the beginning, because the calculation of the company or organization recognizes its most energy-wasteful and environmentally damaging actions. On this basis certain measures can be developed and adopted to increase energy efficiency and reduce harmful impacts on the environment. The calculation of the carbon footprint is therefore meaningful only if it is followed by appropriate action and work towards reducing harmful emissions and increase efficiency (''Carbon footprint'' [Umanotera], bd).

There are many reasons that tell us why we should decide to calculate the carbon footprint. In any case, the primarily important reason for the reduction of GHG emissions and hence reduce the costs is associated with the use of energy. They are also important following reasons: ***development of new products or services, brand building, market differentiation of products, services and organizations, early adaptation of the upcoming stricter legislation, participation in various programs to reduce greenhouse gas emissions, meeting the expectations of customers, subscribers, employees and other stakeholders, increasing customer satisfaction and loyalty*** (''Carbon footprint'' [Ekogenca], bd).

If we want to calculate the carbon footprint precise, it is important to systematically and thoroughly classify all possible sources of emissions. We usually use a common classification of emissions according to the degree of control that the organization has on emissions. Thus, GHG emissions can be divided into three main categories: direct emissions from activities the organization controls, emissions from electricity consumption, indirect emissions from products and services. In the first group, the most common is the various types of combustion of fossil fuels in the production of CO_2. Some organizations directly emit other GHGs.

Thus, for example, in the production of certain chemicals methane (CH_4) is produced, in the use of nitrogen fertilizers nitrous oxide (N_2O) is produced, etc. In the group of emissions from electricity consumption it is necessary to know that at work we mostly use electricity for lighting and to drive various devices. Electricity can come from various sources, including the fact that they are environmentally friendly. However, the bulk of electricity is still produced by the combustion of fossil fuels. Although the organization does not have direct control of these emissions, it is indirectly responsible for the produced CO_2 with the decision for this type of energy. Also, emissions from categories of indirect emissions from products and services have a significant impact on the carbon footprint. Any service or product that organization buy is cause for a certain amount of the emissions. Thus, for example manufacturing company is indirectly responsible for the CO_2 that is produced in the preparation and transport of raw materials. Then organization can add to its emissions also emissions which arise in the application of their product (Umanotera, 2009).

Of course, the calculation of the carbon footprint that covers all three types of emissions is very difficult. Also, an additional problems occur, since the carbon footprints are rarely comparable because – despite the emerging international standard – organizations do not calculate their carbon footprint the same way and do not even classify the same emission sources. Also, the carbon footprint is displayed in the selected time period (the footprint of individuals or companies are usually measured for a period of one year, but can also be displayed on the unit, for example – depending on the event or product purchased) (Umanotera, 2009).

Carbon footprint can be calculated for several things. It can be calculated for each organization, but it can also be calculated for the product itself. Thus, there are two types of carbon footprint which will be presented below.

3 Carbon footprint of the organization

The carbon footprint of the organization includes all of the Emission of GHG emissions from all activities and operations of the organization, including the energy used in buildings, industrial processes and vehicle companies. Calculation of organizational carbon footprint enables the organization insight into the key sources of emissions, and how much, and how the organization impact on global emissions. Thus, each organization easier to understand and perceive what its potential for reducing GHG emissions. On the basis of this single organization can develop a program to reduce the carbon footprint. To calculate the carbon footprint is commonly used standard Greenhouse Gas Protocol (GHG Protocol), which specifies how the carbon footprint calculation. GHG Protocol categorises emissions into the already above mentioned three categories: *direct emissions from activities the organization controls, emissions from electricity consumption, indirect emissions from products and services* (Carbon Trust, 2012).

When calculating the carbon footprint of the organization is to be taken into account six key steps:

1. **to define the necessary methodology,**
2. **define the boundaries and scope of included data**
3. **collect data,**
4. **use emission factors,**
5. **to verify the results (optional)**

For an accurate calculation of the carbon footprint it is very important to choose the correct methodology. GHG Protocol is one of the most widely used standards. It is available for free on the web and provides detailed guidance on methods. Another recognized standard is ISO 14064, which is built on many of the concepts introduced by the GHG Protocol. It is also very important to the calculation of the margin and the extent of all data, ie which parts of the organization will be included in its calculation. For the calculation precision it is very important how accurate information on all sources of emissions will be collected within set limits. This is the way data on gas consumption and energy in kilowatt-hours (kWh) is collected. Consumption of other fuels can be expressed in different units such as litres, MJ, kWh, etc. (Carbon Trust, 2012).

The most important reason for determining the carbon footprint is the desire of organization to identify and control its footprint and gradually reduce its emissions in the context of environmental policy measures. In other words, it means the determination of the key and most important resources, interests and contributions of individual activities (the organization), and the phases of the life cycle (for products), design measures to reduce emissions and their continuous monitoring. The determination or calculation of the carbon footprint is carried out in accordance with the requirements and recommendations of standards, namely the Protocol for greenhouse gases (GHG Protocol: A Corporate Accounting and Reporting Standard) and Specifications for the determination of greenhouse gas emissions in the life cycle (PAS 2050: 2011).

Carbon footprint of the product

Carbon footprint of a product is the calculation that shows us all GHG emissions over the life of each product, from raw material extraction and manufacture through to its use, reuse, recycling and disposal. Is the opposite of organizational carbon footprint, it also includes emissions generated outside the boundaries of organizational activities. Carbon footprint of a product is a useful tool to encourage cooperation with employees, suppliers, investors and customers. You can encourage employees to take measures to reduce emissions, help build value and brand consciousness, but also supports the actions of suppliers and customers to reduce emissions. You can also display weaknesses and the potential savings of its own processes and supply chain. PAS 2050 (Publicly Available Specification) provides commonly known international use and accurate method for estimating GHG emissions in the life cycle of the product. It is used for a wide range of goods and services and includes the scope of the analysis, data collection and calculation of GHG emissions. It provides guidance on how to address emissions in relation to issues such as recycling, renewable energy and land-use change (Carbon Trust, 2012).

Determination of the carbon footprint of the product includes the following major steps: make a plan of procedure, review the boundaries and prioritization, data collection, calculation footprint, footprint verification. First, it is necessary to make a list of all materials, activities and processes. It is necessary to check the boundaries and establish priorities, as some emissions can be excluded, for example, travel consumers to retail outlets. The calculation of the carbon footprint at a high level will help focus Assembly information on the main sources of GHG emissions and thereby exclude others.

After calculating the footprint it is also verified with three options (Carbon Trust, 2012):

- *independent verification,*
- *verification by a third party (eg another company) and*
- *accredited independent third-party verification of identity.*

The LCA method

Environmental impacts of products (including packaging) are varied and diverse. Finally, it became clear that the necessary products to address comprehensively, in the sense that they occur impact on the environment in all stages (phases), which are necessary to the product occurs during and after use. This concept is crucial for improving the environmental profiles of products and materials; it allows environmental interventions and improvements along the entire value-added system.

Analysis based on environmental life cycle of the product, has become one of the most important methods of assessing the effects of products on the environment.

This complex method of analysis we try to gain insight into the entire product life cycle, which includes:

- extraction of raw materials,
- the acquisition of energy resources,
- production and distribution of energy required
- production of semi-finished products and by-products
- transportation and distribution,
- effects during use and
- alternatives handling of the product after use.

Such an approach is particularly important when there are alternative routes and choices of those variations are less harmful to the environment.

Figure 11: Environmental product life cycle

Source: Garant, 2010

The method of LCA (Life Cycle Assessment Summary) tries to assess (evaluate) all impacts on the environment, which in its life cycle provokes a product with the aim that this product is environmentally optimized. It represents a compilation and evaluation of all inflows (inputs), effluent (outputs) and the potential environmental impact of certain production system throughout its life cycle.

The LCA method is currently the only internationally standardized method for assessing the impacts of products throughout their life cycles. It has become the leading method of ascertaining the impact of products on the environment in the world. With it we find both, advantages and risks, for the optimization of products from raw material extraction to waste management.

The results of the analysis of LCA represent the information base for decision-making in the context of wider environmental policy of the company. They can help in determining how different technological processes differ in terms of environmental impacts, which are the most influential stages in the life cycle and where environmental impacts are most problematic and where the life cycle occur. Furthermore, the findings of the LCA figure out how to change the effects on the environment, if a company decides to change the packaging materials and how they change impacts on the environment, if we change the transport route for goods or packaging materials from a new supplier.

In the analysis of LCA we should always determine the carbon footprint, which is part of this method from the outset. With a holistic approach to the impact of the product on the environment we can best ensure that the materials are not selected on the basis of subjective decisions to identify the most relevant environmental impacts and focus attention on them in order to further examine the impact of auxiliary materials, which may be the environmental point of view often highly controversial, the design focuses not only on the environmental impacts of products, but also on the entire production-distribution system and, ultimately, to prevent environmental impacts 'for moving' from one phase of the life cycle to another and vice versa, i.e., in order to avoid the negative effects of the modifications.

4 City Logistics

Since the majority of the developed world's population lives in cities, city logistics in becoming more important every day. With predictions that urbanization trends will continue to grow, we can expect that every company will sooner or later be faced with the question of supply to cities and their inhabitants.

Urban areas have many specifics, such as road infrastructure, limitations for traffic and access, and initiatives for significant reductions of pollution and noise emissions. Therefore, each company should be acquainted with the basics of city logistics in order to efficiently prepare their responses to issues, specific to urban supply.

For the creation of sustainable mobility, it is necessary to consider at least the following approaches and principles:

An integrated (holistic) approach: A sustainable approach requires good planning. For a good plan adequate information and effective analytical tools are needed. An integrated analysis of decision-makers and stakeholders should be allowed to anticipate the effects of their decisions and they thoroughly understood them. The analysis should not be limited to the financial effects of the business and the market.

Integrated and strategic planning: Sustainable design requires that individual decisions support long-term strategic objectives of the community. Transport planning should be coordinated with the environmental, economic and social plans.

Focusing on objectives and results: Sustainable approach requires that the planning is made on the basis of an analysis of the causes and vision or objectives, such as accessibility, pristine environment and increased social welfare.

Respect for equality: The sustainable planning should take into account the effects on equality in society, both present and future generations.

The precautionary principle: This principle emphasizes the importance of including risk in decision-making and supporting policies that minimize risk, whenever possible.

The ethics of conservation: Sustainable approach gives priority to solutions that preserve, enhance efficiency and reduce resource consumption.

Transparency and public involvement: Sustainable approach requires clearly defined and transparent planning process, equal opportunities for stakeholders informed and to participate in decision-making and good communication between professionals and the public.

Equivalence forms of mobility: Each mode has its advantages and disadvantages in terms of capacity, flexibility, energy consumption, safety and environmental impact. A form of mobility that best satisfy the need for mobility should be decided on the basis of the strengths and weaknesses of each of the forms. Modes can be combined in a way that emphasizes their strengths and thus establish a transport chain, which is more efficient, more cost effective and sustainable.

"The polluter pays" principle: Market often causes the price of a product or service does not include all costs. A sustainable approach requires that the polluter pays full price, with costs internalized values. Respect for this principle requires reform of the market - it is necessary to remove incentives for excessive use of natural resources and environmental degradation.

Prevention rather than treatment: The creation of sustainable mobility requires that the prevention of the problems take precedence over their treatment. For this reason, compliance with the principle of an integrated approach of utmost importance.

Transportation of goods as one of the key elements of logistics causes most of the economic and social activities that take place in urban areas. Residents of the city provides "life", as it enables provisioning of stores in which to buy, servicing their jobs, bringing mail and supplies, home, allowing waste removal, etc. Transportation of goods also forms an important link between the suppliers and consumers, thus enabling operation of companies established within the city limits. From all this we can understand the importance of goods transport in urban areas, which still represents one of the major distractions in the city life.

Road capacity is now almost fully exploited, which is particularly true for urban areas. Within these capacities mostly occupied by passenger cars, commercial vehicles have a special role, since they are generally larger, noisier and cause more emissions.

City logistics can achieve great benefits mostly by streamlining distribution activities, which lead to a reduction in the number of goods vehicles travelling in the city. Consolidation of shipments of various consignors and carriers in the same vehicles associated with some form of coordination operations in the city are among the most important ways to achieve the rationalization of distribution activities.

The use of so-called green vehicles and integration of public-transport infrastructure can improve these systems and further reduce truck movements and related emissions in cities. However, the consolidation and coordination are the fundamental concepts of urban logistics. Activities of consolidation take place in the so-called urban distribution centres - UDC (City Distribution Centres, also Urban Freight Consolidation Centre).

This system represents the unloading of a variety of commercial vehicles (dedicated transport over long distances) in the UDC, where the cargo is then sorted and combined well in smaller vehicles transported to their final destination. Meanwhile the logistic system must also provide a recycle stream from sources within the city to areas outside as well as movement between sources and sinks within the city. City distribution centre is therefore a facility where shipments are consolidated prior to distribution. It should be noted that the concept of UDC (as a physical object) is similar to intermodal logistics platforms and Logistics Centre (freight villages) that connect cities in the region, the country, and the world. Intermodal platforms receive large trucks and smaller vehicles intended for local distribution as well as provide facilities for the storage, sorting and consolidation (de-consolidation), as well as numerous related services, such as accounting, legal services, mediation, and so on. Intermodal platforms can be stand-alone facilities, which are located near freeway access, or they may be as part of air, rail or maritime cargo terminals. City distribution centre can thus be viewed as an intermodal platform with enhanced functionality which ensures coordinated and efficient movement of freight in the urban area (Crainic, 2008).

The concept of city logistics also includes potential options for solving problems related to urban transport centres. City Logistics can be defined as the process for full optimization of logistics and transport activities in urban centres, including road environment, traffic congestion and energy consumption.

Taylor (n.d.) highlights certain city logistics initiatives that can be combined and varied by compatibility transport policies in a particular place. These are:

- Check the loading of cargo;
- Underground transport systems;
- Plans for traffic management;
- Developed travel information systems;
- Freight transport systems that encourage cooperativeness;
- Public logistics terminals.

- Basic principles of a comprehensive urban logistics are:
- Integration (consolidation) of individual items;
- Transfer of grouped consignments in urban areas;
- Delivery to the last mile, which represents the distribution of the delivery point to the final recipient.

Urban development is also affected by external factors such as demographic change, mobility needs, climate change and globalization. The development of communications services and technologies and the development of information technology brings new changes in the urban system. Great technological achievement and innovation allow cities to very advanced, but this also shows the consequences. This increases the air pollution of the city, as urban development consumes a lot of energy, transport and land.

Delivery transport in cities

The role of logistics in the problem solving of urban areas is strongly associated with the primary objective of effective and efficient logistics that deals with overcoming time and space. At the same time the logistics represents part of the supply chain that plans, organizes, leads and controls the efficiency of trade flows, storage and related services with the flow of material from the formation to the site of consumption, in accordance with the requirements of end users. Operations which implemented by logistics represent the distribution, supply and collection of goods within urban centres and its surroundings. It represents the process of transport, storage and handling of goods, optimizing and organizing supplies, care for back flow of material through the relief logistics and after-sales logistics processes. In solving the problems of the urban environment it is also required broad concept that through the features of urban flows of goods and services aim to optimize the entire supply chain. So we can say that urban logistics optimizes logistics and transport chain to meet the environmental, transport, social and energy requirements through the features of the urban environment. In this context it is necessary to take into account that almost all loads finally end up in urban areas - since that is where the consumer market.

To understand the problems of urban logistics is necessary to emphasize certain characteristics of urban environments:

<u>High population density and consumption:</u> Europe is home to more than 75 % of the population in urban areas. Rapid urbanization has led to major problems. Densely populated urban centres require delivery of larger quantities of goods and generate the need for a larger number of vehicles, which has a negative impact on the living conditions, mobility and habitat. Thus, for example, generated annual quantity of goods and cargo in Paris is 15 tonnes per capita (Zečević & Tadić, 2005).

<u>The industry is mainly concentrated in urban areas:</u> In Europe, over 80 % of road freight transport is realized at a distance of 80 km, which can be defined as regional - urban transportation. Research carried out by the company Iveco in nine European countries showed that about 48 % of the vehicles 'orbits' within cities and urban centers and 32 % of the vehicles in the suburban area. (Allen, Thorne and Browne, 2007). In Italy, over 70 % of cargo has the final delivery within its source area. Over 50 % of goods transported over a distance of 50 km and 25 % within the site itself (Zečević & Tadić, 2005). Urban freight transport contributes on average 10 to 20 % of the overall urban transport (CIVITAS, 2008).

<u>Impacts on the environment and transport noise:</u> The consequences of road freight transport on the environment are great. One truck produces the same amount of harmful substance (gas), such as passenger cars and causes noise, which is equal to 10 to 20 car. The reduction in freight transport by 4 % in the production of noise has the same effect as a reduction of passenger cars by 50 %. In the city of Bremen, which has about 500,000 inhabitants, the daily consumption is around 500 tonnes of fuel,

while in Zurich one third of the population lives in an area with noise, which is on the border legally permitted (Zečević & Tadić, 2005).

Urban transport represents mainly the endpoint of the transport chain, where there are lot of a small loads, which requires specific means of transport. Characteristic of freight transport is also reflected through the distribution costs, which represent about 40 % of the total cost of combined transport "door to door". The importance of these costs in the future is even greater, because of the trend of reducing inventories and smaller and more frequent deliveries (Allen, Thorne and Browne, 2007).

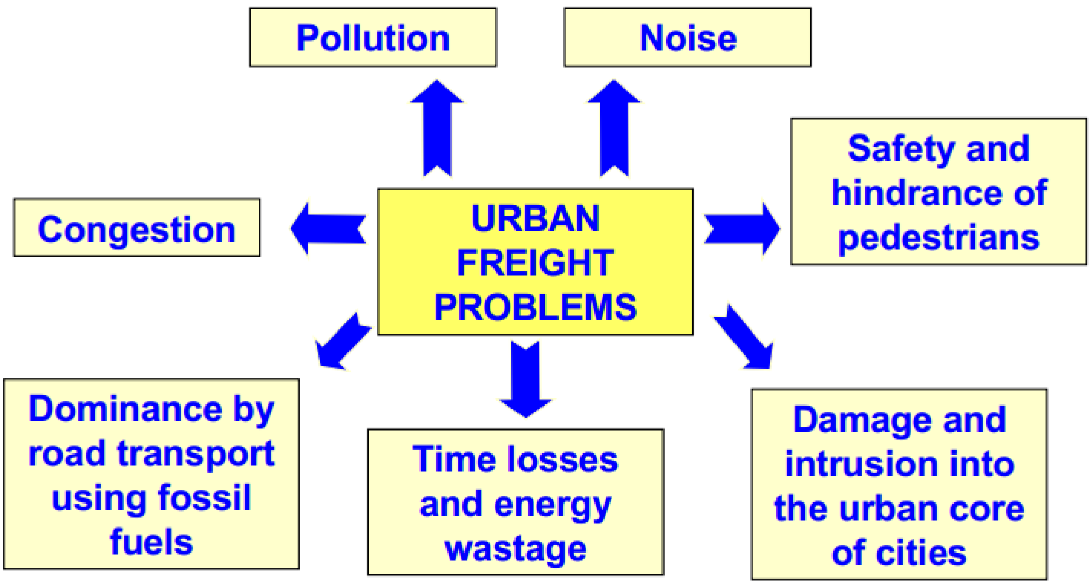
The limited transport infrastructure and space: Transport infrastructure is overloaded and the possibility of its extension are limited, as the limited space to build. Thus, it is difficult to deliver and stop in cities, as in the time of discharge major traffic congestion can be caused. The losses due to unloading of goods in cities in the United States are around 2 billion hours and approximately $ 16 million (Zečević & Tadić, 2005). Problems related to accessibility are more related to the size limits of vehicle and load imposed by the city authorities, and the time of delivery, in the desire to improve the quality of life in cities.

Poor utilization of freight assets: In Rome 75 % of all commercial vehicles have only one destination - the problem of empty vehicles; less than 20 % capacity utilization commercial vehicles (CIVITAS, 2008).

Customer requirements for high product diversity, which leads to the need for larger premises for shops and smaller rooms for storage. For example, in the town of Genoa the size of deliveries is less than 15 kg in 40 % of cases, and in the city of Vaasa in Finland the average path length is about 0.9 km per capita (Zečević & Tadić, 2005).

The share of freight transport on energy consumption and pollution is higher than the corresponding percentage in kilometres. It is anticipated that by 2030 freight transport will consume 45 % of the total energy, and freight transport will increase by 63 %. (CIVITAS, 2008).

Figure 12: The problems of urban transport



Source: Quispel, 2002

Problem solving of urban logistics must be comprehensive and requires the participation of all stakeholders in the transport and logistics chain and various policies (such as planning, time...). These actors include:

- producers,

- distribution companies,
- consumers or recipients and
- representatives of the authorities.

In the non-harmonized operation of all actors' interference, inefficient urban logistics, and deviations from the common interests of all the inhabitants of the city usually appear. Often there is a gap of private interests when individual companies compete with each other and their behaviour is rational, and interests of the public, which seeks to optimize the total urban logistics of macro perspective. This gap represents the desire to combine transport routes and its reduction, while limiting the allowable delivery time in cities on the one hand, while on the other hand, such a desire for the optimization of commodity flows in the city represents disorder in the process and increase costs for the individual enterprise.

Each participant has their own tasks; it seeks to carry out a variety of ways. Consignors are carriers' customers, and they send or receive products of other companies or persons. Submitters want to increase their level of productivity, including: cost, time the lot and reliability of the service provided.

Problems due to urban freight transport

Due to population density within urban areas and limited resources (infrastructure, environmental resources) urban freight transport has to cope with many problems. In addition to the high density of population and consumption there is still a high density of buildings. Hence, the transport infrastructure is very limited and the chances increase / the spread of the latter is limited by the lack of unoccupied areas. On the other hand, underground facilities are very expensive and can be afforded only in rare cases. Due to the burden of traffic infrastructure in urban areas the environmental aspects are of great importance, especially with regard to emissions and noise pollution caused by urban freight transport.

Urban transport has their requirements as part of a chain of freight transport. Access to urban centres is limited due to the narrow roads, congested road networks and constraints in the road due to the high density of population and their requirements for environmental impact. As the urban freight transport in particular, the distribution of goods at the end of the conveyor (supply) chain, the loads are mostly small, which leads to many trips.

If we want urban freight transport to be integrated in the transport (shopping area) chain, we need to find a compromise between the requirements of urban freight transport and other parts of the transport chain. Unfortunately, this compromise often leads to congestion of transport over long distances, without taking into account the requirements of the urban freight transport.

Optimization of traffic flows within the urban centres is often not in accord with the interests of the partners involved. They tend to optimize their traffic flows in accordance with their own needs, but often do not comply with the objective of overall optimization.

Distribution centres

One of the possible forms of optimization is certainly brand building distribution centres as concentration points in the transport (supply chain), built near urban centres, where the vans that travel daily in urban centres collect the goods would be distributed to the cities organized and optimal way in order to address the individual problems of recipients who do not have coordinated logistics and causes many (unnecessary) driving and pressures on the environment and infrastructure.

In practice, it has been shown that this form of optimization of freight transport organization opposed too many reasons, which are reflected in:

Lack of interest of management: Goods distribution centres represent only a disturbance in the supply chain, which is linked to the cost of the distribution company (unloading, distribution and consolidation share 1/3 of the total transport costs);

Lack of willingness for co-operation: The purpose and objective of the trade and distribution centre is the aggregation of all traffic distribution companies in a particular area through co-ordinated global logistics. However, this requires cooperation between separate enterprises. Due to the strict competitive relationships between such companies, for such participation is not of interest;

Lack of identification: Delivery by a third party, such as the coordination of the delivery distribution centre, is often rejected because of the lack of direct contact with the manufacturer. Moreover, the distribution company is interested in running the city centre with its goods vehicles because of publicity. Commercials;

Reduced needs: In recent years there an enormous concentration process in retail stores led to the formation of large retail chains that manage their own logistics etc.

5 Reverse logistics

After-sales Logistics as a Logistics System Feedback Loop

According to Oblak (in Logožar, 2004) the after-sales logistics operations can be divided into:

- After-sales services of the seller, and
- Reverse logistics.

After-sales services include the following activities of the seller (Logožar, 2004):

- Installation and trial machinery operation,
- Service, current and investment maintenance, and
- Delivery of the needed spare parts.

Maintenance is undoubtedly an important and complex business process, which in many ways differs from other processes. For its effectiveness it is crucial to know its basic principles and requirements, as well as modern management methods. We must be aware of the fact that the effective maintenance of means of production (the most important machinery, equipment and other fixed assets) is essential for effective and efficient, i.e. competitive business of most organizational and business systems. While this is often one of the least externally observable processes, a reliable maintenance is important for every day working practices. Therefore, maintenance should become one of the critical business functions, requiring strategic consideration many a time.

Reliability of different means of production is subject to system maintenance, whereby in the life cycle of a certain production means the necessary procedures should be foreseen that influence the state of each component, assemblies or a device as a whole. The concept of maintenance is still too often considered to have a negative connotation. It is understood as a necessary evil, a cost, "firefighting", etc.

Reverse logistics includes the following activities (Logožar, 2004):

- Return of ancillary transport equipment (pallets, containers, demountable loading crates, reusable packaging, etc.),
- Re-use or destruction of waste or residues from the manufacturing process, and
- Claims for damaged or incorrect deliveries.

Open Joint Stock Company "Russian Railways" offer its customers a green technology including multimodal supply chain

October Railway - a branch of Open Joint Stock Company "Russian Railways" **(**JSC "Russian Railways") - offered shippers to develop "green" supply chain and to shift from road to rail.

With the growth of the share of rail transport in the structure of the supply chain can optimize fuel consumption and thus emissions of carbon dioxide (CO_2) into the atmosphere.

Today in Russia CO_2 emissions by 1 million tonnes-km with road transport account for 81.8 million tons, the railway - 29.4 million tons. That is, the fuel consumption of motor vehicles three times the consumption of rail. Nevertheless, a large number of goods in Russia, despite the great distance, yet delivered on motorways. According to the White Paper, the European Commission adopted in 2011, in Europe, all passenger and freight transport a range of over 300 km should be carried by rail. In Russia, organizing the logistics chain, companies still rely on the parameter margins. According to the company “Heineken Russia”, carriage by road at a distance of 2.5 thousand. km today more profitable than transportation by rail.

If we talk about long distances, such as, for example, the route St. Petersburg - Irkutsk, it is obvious that the only possible transportation network Railways and no alternative. But now customers are more interested in transportation "door to door", and so far only vehicles give them that opportunity. Of course, to make cargo move on the railway without some motivation today is difficult. However, JSC "Russian Railways" in accordance with the requirements of the market offers its customers green technologies, including multi-modal supply chain. For example, last year the JSC "Russian Railways" has acquired a large car operator – “GEFCO”, and now, by combining two types of transport can offer shippers, sending custom-made, high-yield cargo delivery "door to door".

With regard to specific examples, then, according to the October Railway, in the past year through the development of a technology called "Block-Train" was able to remove from the road more than 10.5 thousand Heavy-duty trucks. The growth of the share of rail transport, even by 1% will significantly improve the situation on the roads, as well as have a positive impact on the environment. This will lead to the optimization of fuel consumption at a rate of 15,418 tons per year (now its consumption by 1 million ton-km is 7114 kg to 2311 kg cars and trains) and will reduce CO_2 emissions by 13,925 tons per year and reduce the number of heavy vehicles on motorways at 47,764 units per year.

Today, October Railway also working to promote the sale of car-seats in the cargo shuttles that follow the Far East without additional stops. This technology allows you to organize backup car-seats in the cargo train, being formed at the station St. Petersburg-Moscow-sorting and next on the schedule. Travel time of the train to Irkutsk, which now stands at about 9 days and 6 hours, will be reduced to 5 days and 20 hours. Thus, the new service should attract new shippers on the railway.

On the concept of "green logistics" may also include technology and lean manufacturing in JSC "Russian Railways". Here interesting experience October Railway in introducing the program "Seven Steps", the implementation of which will significantly reduce the operating costs of the company. So, in 2012 savings of 58.9 million rubbles, for five months of 2013 - 25.5 million. The result was the development of a program of new transport services: freight express trains, integrated logistics, block trains are. According to the October Railway, these services are customers demand.

Require support from the government in the form of subsidies or discounts for mass adoption of environmentally friendly concepts in the Russian Federation (Alexandrova, 2013).

6 Examples of the principles of green and reverse logistics in the Urals Federal District in Russia

As an example of reverse logistics let’s have a look at the project of creation a regional transport network in terms of transition to alternative energy sources, such as recycling timber industry.

According to statistics, in the traditional production and technological cycle, only 28% of the felled tree becomes lumber and other products, the remainder being waste. They are the ideal raw material for processing and in recent years are beginning to attract more and more attention of manufacturers of solid biofuels. However, in the Sverdlovsk region, this waste is not yet widely used for technological and economic reasons. The task of the region to create favorable conditions for the development of this direction.

As part of this project as a subject of study were selected waste timber enterprises, which can play a significant role in the economy of the Ural region of Russia in particular - Sverdlovsk region (Zhuravskaya & Tarasyan, 2013; Petrov, Tarasyan & Zhuravskaya; 2013).

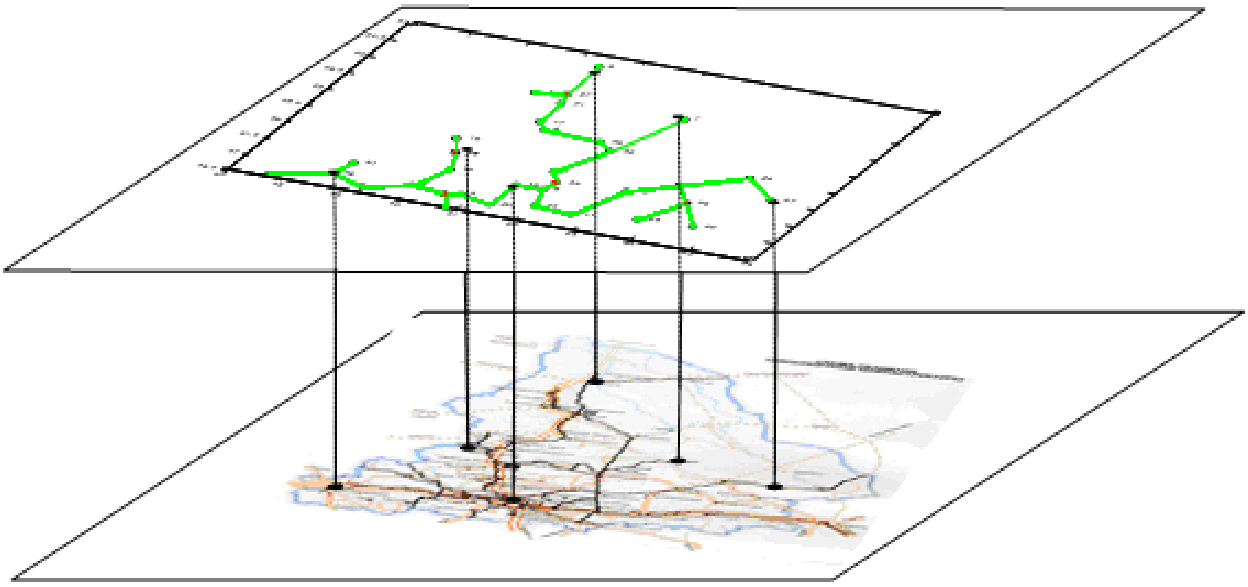
Russia - a major energy state. Two-thirds of exports accounted for oil and gas. However, in the global markets demand for primary energy and raw materials falls, and the demand for alternative energy sources, in particular, for biofuels - is growing. It is expected that by 2020 the European Union level of renewable energy, such as biomass, will reach 20% (http://www.ec.europa.eu> energy/ nergy... doc... renewable... roadmap).

In Russia, there are three major area of lumbering, which include Ural region and, in particular, Sverdlovsk region.

Analysis of forest land Sverdlovsk region revealed that as of January 1, 2013 the total area was 15,247.565 thousand Ha. With the growth of biomass turnover regions want to use their full potential in the supply chain of biomass (http://www.beintrend.ru/2012-10-03-15-03-12).

Rational model of logistic system of nature, where the development of the region is balanced with the gradual transition to alternative energy sources and taken into account the interests of present and future generations is shown in Figure 13.

Figure 13: Verification of mathematical models to real transportation network in the region



An important conclusion became the first choice of options of logistics platforms, which is closer to the real topology (Figure 5), as the network is the cumulative result, it does not disappear.

Thus, successful projects such as Green and Reverse logistics was considered. However, the best solution is to combine these two principles. Today, both the logistics: Green and Reverse are included in the concept of sustainable development. It is clear that only a combination will allow the company to attract attention and get real profit.

As an example of association of the Green and Reverse logistics principles in Russia let’s consider the project for old cars recycling.

Experts estimate that every year in the country comes out of operation about 200 thousand cars, the large number of which become wastes. Meanwhile, the use of science-based car waste and environmental safety areas are closely related to each other. And the important thing here was the creation of a physical system recovery points for the country as a whole and for each region separately. Single model of transport and logistics service area through the creation of a support network of such recycling points does not exist, since the conditions of specific areas differ significantly. The choice of method is determined by the specific area of service benefits to service consumers, as well as social and environmental benefits for the people of the region. The question of the definition of old cars recycling segments in the Sverdlovsk region. As the initial data geographic coordinates of towns of the Sverdlovsk region were used, where the population is more than 15,000 people (Zhuravskaya & Tarasyan, 2010; Kazakov, Zhuravskaya & Lempert, 2010).

Figure 14: Identification and segmentation of old cars recycling logistics areas in the Sverdlovsk region.

Peculiarity of the approach is the ability to divide the studied landfill service into the zones by using mathematical programming methods and cluster analysis based on the theory of fuzzy sets, as well as on the basis of wave method. The results of the simulation of regional logistics system allow us to identify, split into segments, analyze complex work items and generate the necessary disposal management effects such as changes in the network structure, additional resources, the definition of "bottlenecks", etc.

Here are just a few examples of the principles of green and reverse logistics in the Russian Federation. They all demonstrate that the demand for a healthy environment is forcing the economy to adjust the logistics supply chain, starting from the production of certain types of environmentally friendly products and ending with environmentally oriented society needs, implemented in “green” chains of supply (Gladyshev, Bulls, Meshalkin & Shishkanova, 2006).

Logistics today increasingly extends to the sphere of nature management and the environmental protection. Speaking about the prospects for the dissemination and implementation of eco-logistics worldview in the practice of Russian enterprises, it should be noted that the logistics research should be an integral part of the environmental audit of freight and passenger traffic. And the concept of sustainable development can only be based on a combination of the principles of "green" and "Reverse" of logistics.