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ENVIRONMENTAL MANAGEMENT & AUDIT 2
EU - Tempus Project RECOAUD

MANAGEMENT SYSTEMS

Borut Jereb & Darja Kukovič (eds.)



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Retraining Courses for the Sensibilization for and Integration of Eco-Audit Programs in Corporate Decision-Making

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курсы повышения квалификации для адаптации и интеграции программ экоаудита в процесс принятия корпоративных решений

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Contents

Introduction of an environmental management system in oil and gas industry

Vladimir Permyakov, Industrial University of Tyumen, Russia

Vitaly Parfenov, Industrial University of Tyumen, Russia

Sergei Alexandrov, Industrial University of Tyumen, Russia

Yuri Sivkov, Industrial University of Tyumen, Russia

Arthur Nikiforov, Industrial University of Tyumen, Russia

The parallels to Russian reality

Natalia Mikhalenok, Samara State Transport University, Russia

Pavel Pervov, Samara State Transport University, Russia

Elena Gerasimova, Samara State Transport University, Russia

Iurii Kholopov, Samara State Transport University, Russia

Elena Lukenyuk Samara State Transport University, Russia

Infrastructure Planning and Environmental Protection

Marina A. Zhuravskaya, Ural State University of Railway Transport, Russia

Risk management according to ISO 31000

Borut Jereb, University of Maribor, Slovenia

Matjaž Knez, University of Maribor, Slovenia

Darja Kukovič, University of Maribor, Slovenia

Tina Cvahte, University of Maribor, Slovenia

Matevž Obrecht, University of Maribor, Slovenia

CASE STUDIES

Iurii Kholopov, Samara State Transport University, Russia

Igor Gavrilin, Ural State University for Railway and Transport, Russia

Darya Kosyachenko, Ural State University for Railway and Transport, Russia

Bela V. Musatkina, Omsk State Transport University, Russia

Anna Kazantseva, Omsk State Transport University, Russia

Vladimir Permyakov, Industrial University of Tyumen, Russia

Vitaly Parfenov, Industrial University of Tyumen, Russia

Sergei Alexandrov, Industrial University of Tyumen, Russia

Yuri Sivkov, Industrial University of Tyumen, Russia

Arthur Nikiforov, Industrial University of Tyumen, Russia

Table of content

SUPPLY CHAIN AND VALUE CHAIN MANAGEMENT, LOGISTICS AND TRANSPORT

Supply chain management and logistics

Borut Jereb, University of Maribor, Slovenia
Matjaž Knez, University of Maribor, Slovenia
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In the 1950's the term logistics emerged in civilian life (it was previously a militaristic term), as a specific approach of logistics companies (i.e. users of logistics services - companies) to monitoring the flow and costs, as well as logistics facilities (goods) from their origin through to the final consumption. The analysis of logistics phenomena is a specific approach to analysing the operating costs of production, trade and other organizations; additionally, logistical criteria are very suitable for analytical methods used in the evaluation of economic investments (Zupančič, 1998).

Records of large, but not yet sufficiently exploited potential of logistics date back in the sixties, when the global manager guru Peter Drucker said that logistics was one of the last frontiers for the potential increase of effectiveness in the firm (Lambert & Stock, 1993). Even greater emphasis was placed on logistics in the seventies and early eighties, during the so-called oil crisis, which in turn led to rising energy prices. After this, logistics costs were paid much attention, due to the globalization of industry. Logistics was affected in two ways thereof; firstly, the global enterprises began to consider ways of differentiating their offerings of organization, products and services. Logistics became an area in which the local organizations needed to achieve a competitive advantage against overseas organizations, so that they could offer reliable and responsible servicing on the market. On the other hand, entering foreign markets entailed longer, costlier and more complex operations. Good management of logistics processes, therefore, was the tool for the achievement of global opportunities. Later a period followed in which the organizations, because of an increasing competition, started to become more aware of the importance of cost reduction and of operating efficiency. This period coincides with the expansion of information technology, which contributed much to the aforementioned objective, i.e. the cost reduction. Thus, it was easier for organizations to control the whole process of business and logistics activities, such as procurement, transportation and material flows in general; the transparency of stocks was greater and at the same time they started to consider a variety of different mathematical models. In this way, it was easier to plan activities, and ultimately, the first "Just in time" deliveries were made. At the same time, the concept of logistics began being understood as an integrative part of supply chain management, which is also the concept applied in this book.

1 Introduction

Logistics can be understood as a process of planning, implementing and controlling the efficient and economic flow and storage of goods, taking care of the customer-service and all the information related to the use of the adaptations to the requirements of the client. Among the basic concepts of logistics, which consists of logistics chain flows, transportation, inventory management, warehouse management, production planning and cost management are classified. Logistics costs can be defined

given the basic concepts of logistics, as well. The percentage of logistics costs amounts to approximately 10% of the gross domestic product (GDP), for which reason the control and optimization of logistics costs are of the utmost importance for any company. The major obstacle in managing is encountered in setting up uniform and comprehensive enough frameworks to capture logistics costs. Therefore, clear frameworks should be created and all the items of the cost calculation must be predicted. This includes determining the sources of costs, allocation of costs, and the like.

Almost twenty years ago Stewart (1995) recognized the need for the transfer from function-oriented supply chains towards integrated supply chain, which required a philosophical, operational and system changes. Mentzer, DeWitt, Keebler, Min, Nix, Smith and Zacharia (2001) include the increasing incidence of the concept of supply chain and the beginning of an intensive understanding of organizations as links in the supply chains in this period. Although today there is no uniform definition of the very concept of a supply chain, where division between definitions comes mainly in the area of defining all the flows that are classified in the chain, we can assume as a universally applicable definition of Mentzer et al. (2001), "Supply chain is a set of three or more entities (organizations or individuals) who are directly involved in the 'upstream' and 'downstream' flows of products, services, finances and / or information from the source to the end user.". The same authors define Supply Chain Management as follows: "Supply chain management is a systematic and strategic coordination of the traditional business functions and the tactics across these business functions within individual organizations and across all organizations in the supply chain, to improve the long-term operation individual organizations and the supply chain as a whole."

The shifts in thinking and management of supply chains have brightened issues of mutual dependency between the individual links of a chain, their mutual responsibilities and impacts. These sorts of shifts in attitudes and styles of management and integration have led to today's awareness of the importance of linking, integration and cooperation between all members involved in the procurement of end consumers with desirable products and services. With the development of different concepts of supply chain management different requirements on the necessary aspects appeared that have to be taken into account in their work.

Two basic types of supply chains are distinguished, namely: (1) *within the company* and (2) *distribution chains*, which are formed outside the company. A supply chain can be perceived also (Potočnik 2002; Klopčič 2003) as a group of interrelated organizations (from the supplier to the end user) that are directly related to one or more flows of products, services, information, finances, and knowledge, and the common purpose and the goal of which is better supply to the end user and the satisfaction of all the supply chain participants. We should not forget that logistics is an important part of the supply chains; in fact, it is the integrative part of them. It is becoming increasingly clear that the logistics processes that meet the needs of its customers are crucial for any company (Potočnik, 2002). Therefore, logistics is the thread that connects these key processes and lays the foundation for the development of systems that provide for the cost-effective and efficient supply throughout the supply chain.

Business logistics as an independent discipline of business economics balances logistics processes or coordinates activities in the flow of goods and information from the source to the final consumer. The aim of business logistics is constant improvement of the flow of goods and information, both to eliminate the tendency to partial implementation of its own objectives and to ensure the optimal functioning of the whole. The importance of logistics is evident from the studies that were made in the industrialized world, according to which the time of bonding capital in direct production amounts to only 5%, and to maximum 10% of total time in the process of reproduction, whereas the rest of time is divided into the waiting period, handling and transportation and other logistics processes, respectively.

The analysis of movements of goods in space and time has recently become increasingly important. Nowadays there is increasing demand of full tracking of the whole physical flow of goods, in other words: of monitoring the flow of goods in time and space. Some individuals consider the physical distribution as part of the business logistics, which examines the holding and movement of finished products from the production facilities (factories) to retailers or consumers. The second part of business logistics is expected to be physical supply - purchase logistics, which examines the holding and movement of raw materials from their origin to production facilities (Coyle, 1986; in Zupančič, 1998).
Another important factor that influenced the study of logistics was the awareness of the importance of the *customers' satisfaction and their servicing*. With these findings companies finally realized that logistics can be a strategic "weapon" for competition in the markets. Competitiveness is also reflected in the size of the costs that are attributable to logistics. The cost-cutting may be presented by the following example (Lambert & Stock, 1993):

Reduction of logistics costs for 1 USD has a much greater impact on business operations than increasing the sales for 1 USD. The vast majority of the organizations find it far more difficult to achieve the increased sales than to lower the costs. This is especially true in the developed markets, where competition is continually lowering the prices of products and services, and consequently, the entire business system income is lowered. The above hypothesis may be confirmed by a simple calculation. If an organization operates with a two percent rate of yield, it earns $ 0.02 for each sold dollar, and this is the sum, for which its profit before tax is increased. On the other hand, every dollar saved creates a profit of one dollar. At the same time the sales do not need to be increased. Therefore, every dollar saved is extremely important in logistics.

Wherever a business process is employed, it is accompanied by costs. Costs are expenses of production sources, expressed as a price. In business operations each team member has a greater or a lesser impact on the level of costs and on the change thereof, as well as on the causes for their emergence. There are, of course, differences between the impact of the person who prepares expert proposals for the management and the governing bodies and influences their most important business decisions, and the person who puts goods for storage or dispatch on pallets. However, both of them and everyone else in the company, can cause or prevent the costs and thus affects the existence, development, or business failure of a company, or jeopardizes his job and his own life. Every person one is a vital component of the whole and the same applies if one incurs or prevents the costs of the social community. Smart companies pay much attention to costs in their business decisions. Every moment of the work or non-work is therefore associated with the generation of costs.

Their size depends primarily on the impact of three factors:

- On the use of raw materials, machinery wear and the wear of other devices, and on the use of working time, in short, on the use of elements of the business process,
- On the optimization of logistics processes, and
- On their purchase price.

The generation of costs is permitted consciously, because we believe that the work effects (goods and services) shall also be sold well, as it is assumed that there is decent demand for their market placement. With the achieved selling price of the work effects the total income to cover costs and to set up funds is produced on the one hand, whereas on the other hand, the effects of our work generate costs at the customers' expense. The higher costs we incur to them; the higher costs they will incur to their customers. At the end of this chain higher costs will again affect us. Therefore, in business operations we are interested in the minimization of costs, because this enables us to maximize the difference between the total revenue and the cost price of our products or services. This again allows us not only directly, but also indirectly to purchase elements of the business process at the lowest possible price. This is the goal, which every business enterprise would like to achieve.

The primary objective of logistics is often expressed through the concept of "7Ps": the right goods, at the right place, at the right time, in the right quantity, and in the right condition, in the right packing and at the right cost.

In other words, logistics is directed through a concept that meets all the requirements of the users, just through the place, time and volume of delivery. The complexity of ultimate requirements to achieve logistics objectives, can to some extent be illustrated through the stages of realization of flows of goods, thereby paying attention to the corresponding functional differentiation of logistics, to which the multiplicity and diversity of the requirements imposed by both, the flows of goods and users, must be added.

In achieving the above objectives, the role of logistics is to establish the optimal relationship between logistics services and logistics costs, i.e. the existing strategies should be used and the new strategies and concepts developed. In logistics, strategies such as just-in-time (JIT), make-or-buy, outsourcing, insourcing, the concepts of city logistics, logistics control, supply chain management, etc. are effectively and efficiently[1] applied in order to increase the supply chain performance. Crucial features of these strategies are integration, concentration, cooperation, coordination and specialization.

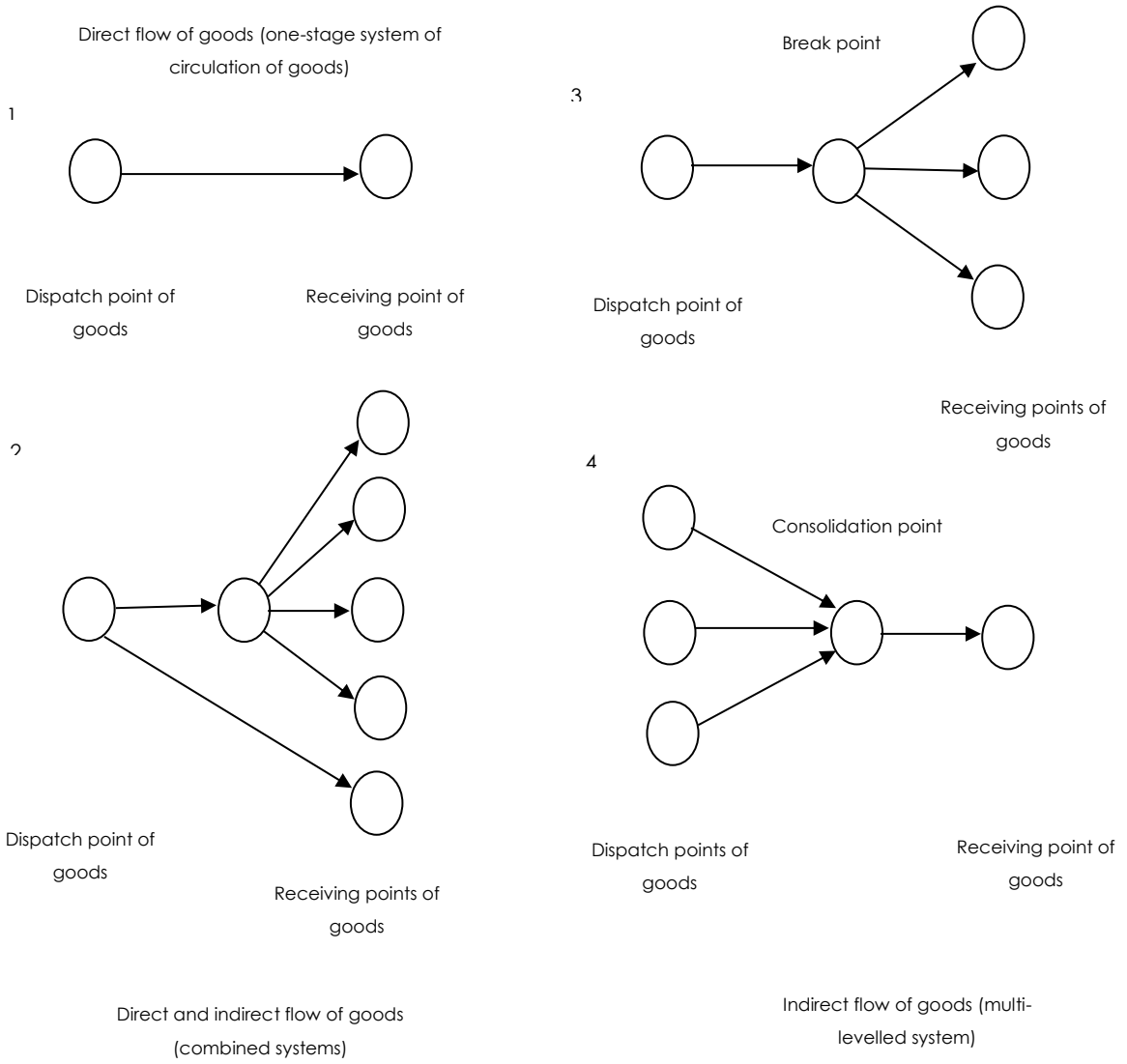
The development of logistics activities is affected by the following five global megatrends (Knez, Cedilnik & Semolič, 2007):

- increasing market globalisation with
- simultaneous individualization of customer wishes,
- information technology,
- environmentally favourable implementation of logistics services, and
- a growing presence of terrorism and crime.

The intertwining of transport and storage processes is characteristic of logistics systems. Graphically this can be illustrated by the network on which hubs and transport routes are interconnected. Objects move on this network and at the hubs they will be temporarily withheld or redirected to another transportation route at this macro logistics network. Various connections between hubs represent various options for moving the object across the network. No matter which objects (things, energy, information, living creatures) move (are transported) across the macro logistics network, the issue is about a logistical system. At our work we will be putting emphasis on real goods as logistics objects. In such systems, logistics information flows are not created only for their sake, but they are derived from a physical flow of goods (Oblak, 2007). Drawing on the contemplations about the networks we can distinguish the basic infrastructures of logistics systems, as are graphically illustrated in the following figure.

5 Efficiency is doing things right, whereas effectiveness is doing the right things. Therefore, the effectiveness is an internal characteristic of the system, whereas performance is the external characteristic of the system. (Rosi, 2008).

Figure 1: Trade flows



Source: Oblak, 2007.

The basic function of logistics systems is the spatial-temporal transformation of goods, including the function of quantitative and assortment transformations of goods. The function of logistics systems also includes facilitating the following types of goods transformation (Oblak, 2007):
transport, cargo handling and warehousing processes (the core processes of the flow of goods) and packaging and labelling procedures (supportive processes of the flow of goods).

2 Supply Chain Management and Logistics of the company

The era of global business expansion and modern lifestyle causes rapid and increasingly difficult manageable growth of trade and information flows within companies and between them. In the past we dealt with business functions in a company (purchasing, production, finance, sales ...) separately, today the profession is increasingly devoting their integration due to interdependence. The study of supply chains within the company and between business partners is giving any company the potential to become the most competitive and flexible in the face of rapidly changing market conditions. It will

complete satisfaction of the customers' requirements or expectations. As a response, the corporate strategy of companies prepared for the challenges of the 21st century with the set of activities where supply chain and logistics management have the key role. The strategic importance of such management increases with the number of i.e. megatrends that increasingly affect the operations of each economic operator. This should not be unilaterally regarded as a cost, but more comprehensive, i.e. as a key source of both competitiveness and the long-term existence of the company. We must promote innovation and systems thinking on and in it.

Companies today are faced with increasingly demanding customers who expect a still higher level of servicing their needs, so the company can very quickly lose their market share if they cannot maintain high quality services. Development trends of supply chain and logistics management are largely dependent on the globalization of the world economy, which has boosted the range of factors that affect output growth, equalization of products and user needs. Competition between companies is increasing, the life cycle of products is getting shorter, and the newly created circumstances would require all participants in the supply chain to adapt to these changes. In the adaptation and survival of companies on the market in the future, logistics and supply chain management will certainly play a decisive role, as it will be involved in decisions about the success and failure of the company, so the cost of logistics plays a decisive role in the company's competitiveness in the global market, which is one advantage that makes it recognized in the market as different and better than other providers of the same service.

The opinion that the logistics activities and processes are inherently presenting costs is too generalized. This stems from the belief that storage, transport and handling of materials and stock activities presents costs and do not bring any added value. If you take the added value in general as an increase or improve the value, price, functionality and usability, then this is not the case. Of what value is, for example, a product which is in the supplier's warehouse and not on the production line or on the shelf in the store? How much is a cutting tool useful in the store? If logistics really presents only costs, why we are building a modern warehouse for incoming material and components and for output products, transport lines and systems, distribution centres and robotic handling of materials and products etc.? Probably because the flow of material throughout the supply chain is not possible without transport, storage, and handling of materials and products.

Increasing competition in international markets therefore forces companies to innovate constantly. Companies must constantly prove that they are trustworthy of regular customers while expanding into new markets. This is only possible if businesses are market-oriented. Markets should also be directed towards all operating systems in the enterprise which includes the increasingly important business function of logistics.

Market orientation of logistics and whole supply chain management is required in particular to fulfil the following conditions:

- knowledge of the markets,
- introduction of the concept of effective serving of customers,
- offer adequate quantities of goods at reasonable prices, and this in the right place at the right time,
- the establishment of such prices that maximize sales and
- the introduction of after-sales service.

A logistics system must therefore have the goal of its operational guidelines which will meet customer's demands and contribute to the overall performance of the company. Only with pre-set goals we can evaluate the results of its operations. The aim of the logistics system is optimal supply of production with the necessary materials and energy, and the optimal supply of consumers with products in the

required quantity and quality at the right time. It is therefore its intent to achieve an optimal level of supply and delivery service (Ogorelc, 2004, p. 23).
Logistics management is the process of planning, implementation and controlling the efficient, disposable flow and storage of goods, services and related information from origin to the place of consumption, in order to adapt to customer's requirements (Lambert and Stock, 1993).

Table 1: Objectives of logistics activities

The objectives of logistics activities of the company are:
Ensuring the involvement of logistics in the entire business process
Recruitment and training, providing expertise and relationship of certain business functions within the company
Securing the necessary resources for undertaking the required quantity, quality, at the right time and the right place - ensuring a smooth work process
Ensuring distribution of goods to customers in accordance with the requirements
Coordinating delivery of resources to the financial possibilities
Maintain good business relationships with business partners and customers
Ensuring transparency of work, reliability and accuracy of performing the tasks and the flow of information on the state and changes in the environment.

Planning as a process of objectives' and activities' consolidation which should be done to achieve them, represents the initial phase of logistics processes in the logistics system of modern enterprise. Management of logistics processes begins with the identification of the purpose and objectives of the logistics system, which is the function of the realization of the aims and objectives of the company. The purpose of the logistics systems of the company is to meet its needs and the needs of its core information and knowledge from origin to final consumer (Ogorelc 1996, p. 121).

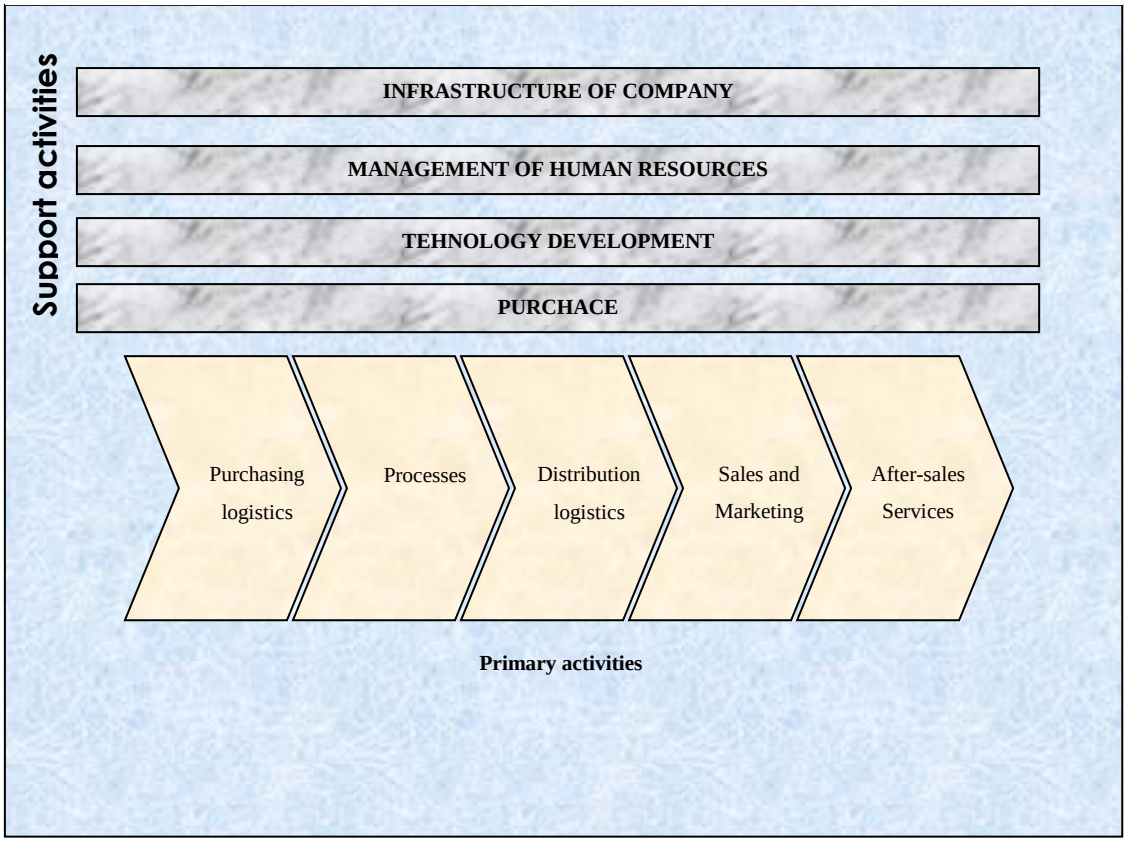
3 Value chain as a part of supply chain management

A key source of company's advantages is its set of operational processes, which represents their value chain. These processes are also the source of price or cost differences from competition – their rivals. The more value an organization creates, the more profitable it is likely to be, and when you provide more value to your customers than rivals do, you build competitive advantage. Critical elements in a superior competitive strategy are in understanding how your company creates value, and looking for ways to add more value.

What is value chain?

Rebernik (1997) defines the value chain as a set of activities with which the company creates value for the customer. Porter (1985) divides activities in the model of value chains into primary activities and support activities, which basically means creating value of product or service.

Figure 2: Porter model of the value chain



Porter (1985) ranks among primary activities:

- Purchasing logistics,
- Processes,
- Distribution logistics,
- Sales and Marketing, and
- After-sales Services.
- Purchasing logistics includes:
- acquisition of goods,
- storage of raw materials,
- control of stock, and
- the optimization of the transport.
- Processes include:
- the basic process,
- packaging,
- assembly,
- maintenance of equipment.
- Distribution logistics includes:
- the storage of finished products,
- completion of orders,
- transport, and
- Distribution Management.
- Sales and Marketing include:
- marketing,
- the choice of marketing channels,

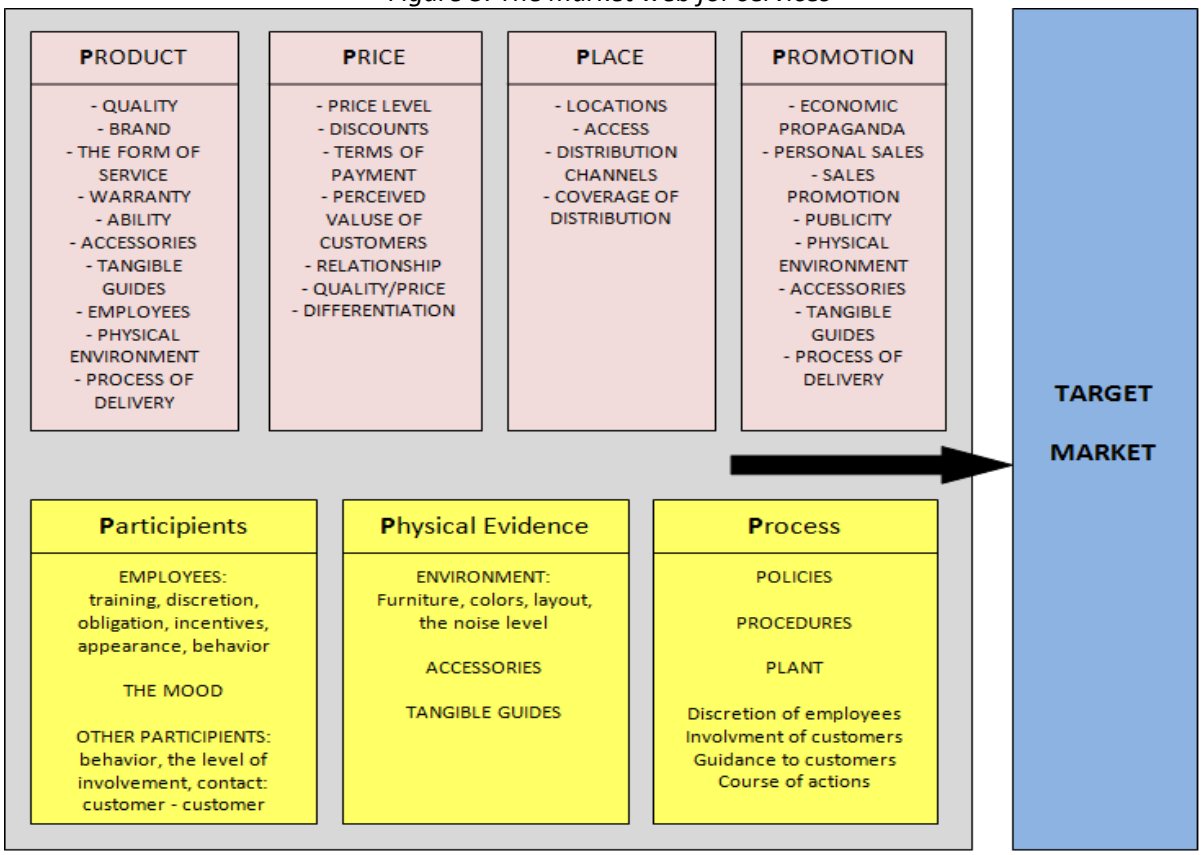
- sale,
- calculation of selling prices, and
- retail management.

There are many definitions of marketing. The most widespread perceive marketing as all operating activities that are associated with the pathway of products and services[2] from producer to final consumers. These activities are mainly purchasing, storage and selling. The sale will also involve the distribution activity. The aim of the sale is made only when the product or service reaches the final consumer or the place of market consumption.

According to Peter Drucker (2001), one of the leading world-renowned expert management, "Marketing represents such an all-encompassing activity that is difficult to define as a separate business function of the company, as all activities related to the same goal, that is, the satisfaction of the consumer."

Philip Kotler (1996), one of the leading world-renowned experts in the field of marketing defines marketing as a way of thinking or philosophy of business in the world:
"Marketing is a social and managerial process that allows individuals and groups to get what they need and want, and therefore its role is to create, offer and exchange with other products (services) that have value."

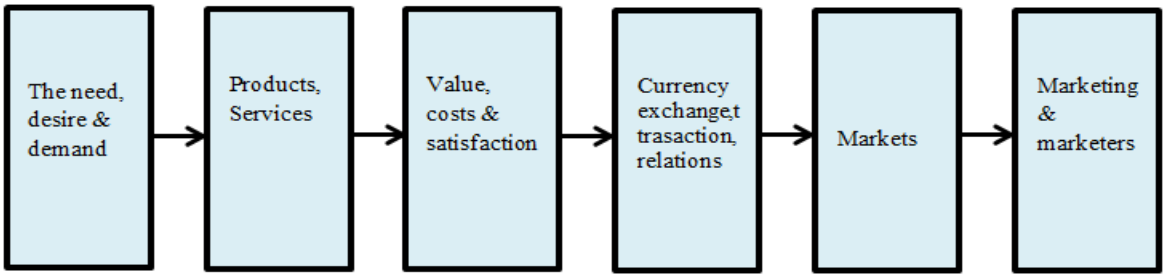
Figure 3: The market web for services



Source: Potočnik; in Angelovski & Sternad (2005).

[2] Service or product is all that can satisfy the needs of people or companies.

Figure 4: Process of marketing

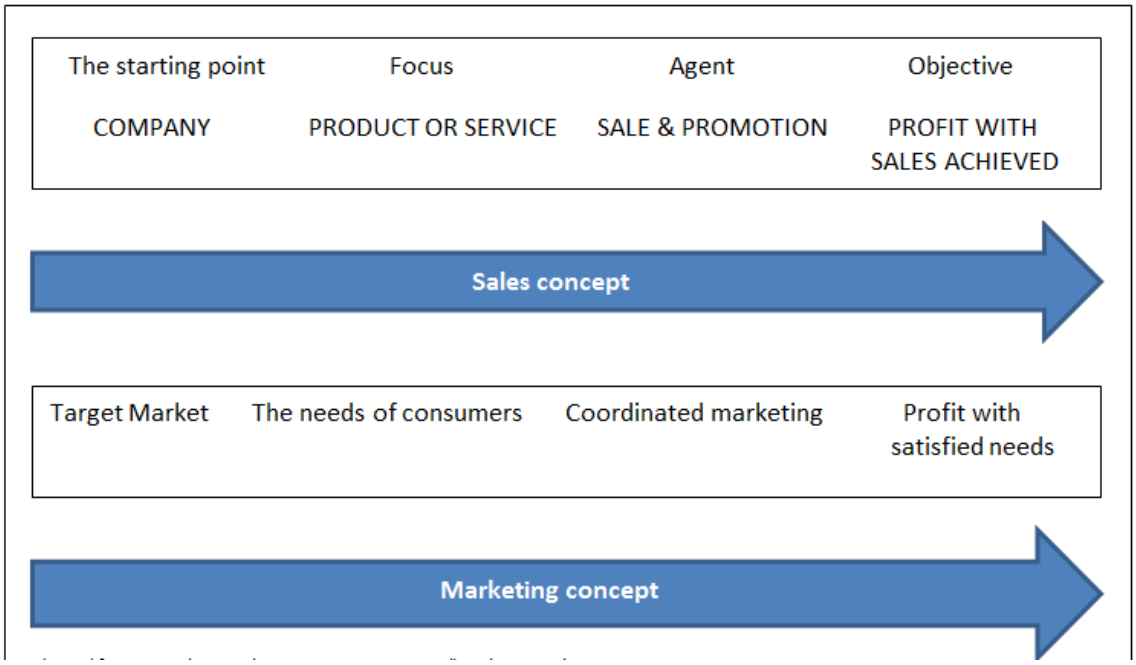


Source: Potočnik (2000)

The key to success is to identify the needs and desires of the target market of consumers. First, it is necessary to identify user needs and then offer a better service than the competition. It is necessary to precisely define and understand customers and greater customization. The expectations of consumers as to the quality and additional services increase.

Since the company wants to succeed, it must pay attention to internal marketing (raising motivation and company culture) and external marketing (public relations outside the company).

Figure 5: Marketing and sales concept



After-sales Services include:

- customer Support,
- customer service,
- establishing a system,
- the supply of spare parts,
- update the system, and
- training of employees to work with the system.
- Porter (1985) ranks among support activities:
- purchase,
- technology development,

- management of human resources, and
- organizational structure of the company.

Some authors (Androjna & Rosi, 2008) define the concept of value in financial terms as the sum of all future free cash flows, discounted at the current time. The first part of the definition talks about cash flow, which is actually the difference between revenue and expenditure. The second part of the definition is derived from the time value of money, i.e. the fact that one euro today is worth more than one euro in the next year. Therefore, future cash flows should be corrected using a discount rate to obtain their present value.

For our consideration we will define value as the amount that the buyer is willing to pay for a particular product or service and which generate a perception of the benefits that the customer gets when buying a particular product or service. Value can be defined by the equation, namely:

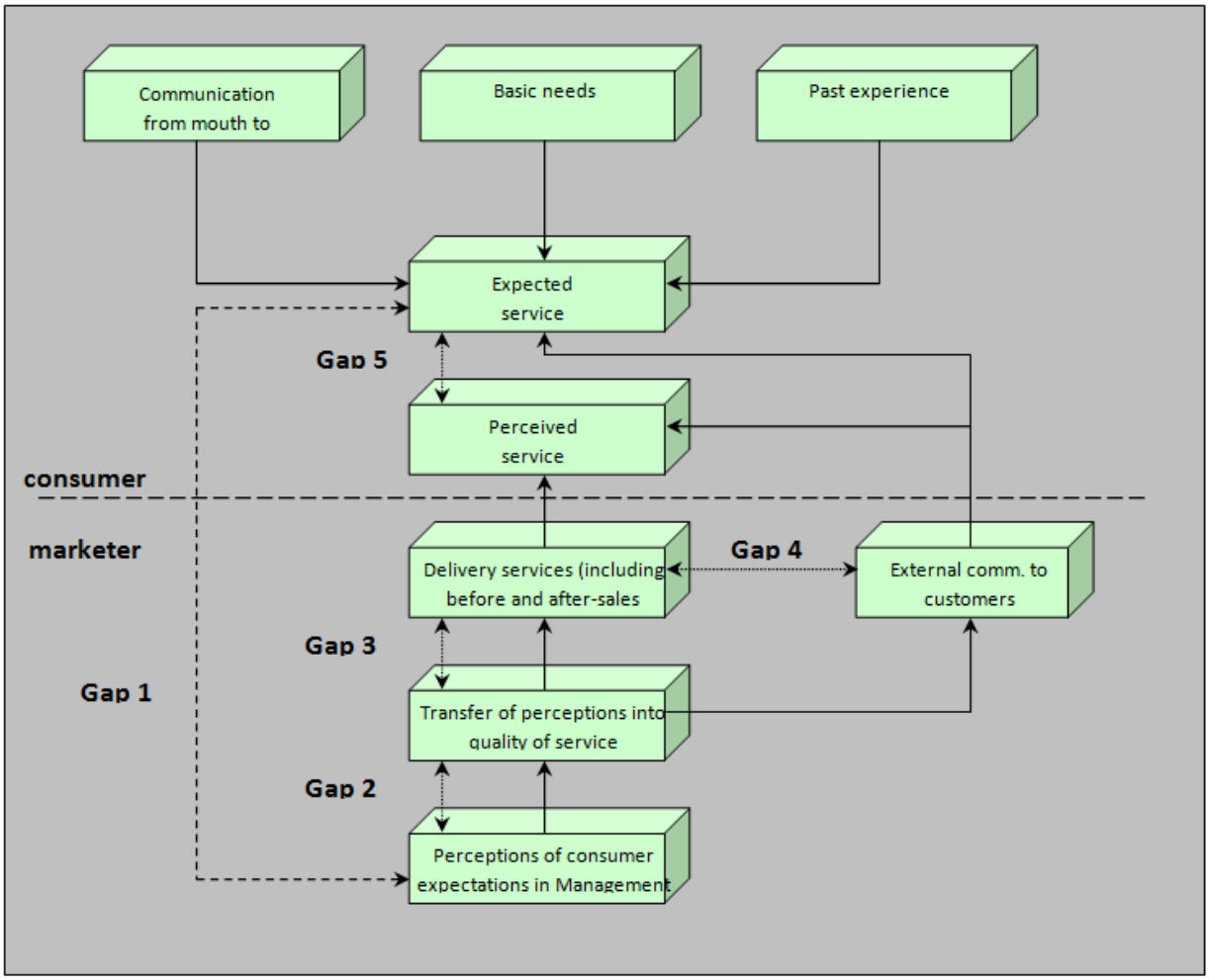
$$\text{customer value} = \frac{\text{quality} \times \text{service}}{\text{costs} \times \text{time}}$$

Value arises in the eyes of the customer, because people have different perception range, thus the values differ from each other. Customer value can be defined as:

$$\text{value} = \frac{\text{preception of benefits}}{\text{costs of ownership}}$$

Quality is seen as functional or technical specification of offer. The functions of quality assurance should cover the whole spectrum of the business. Quality assurance in the company represents a set of measures to achieve all the requirements and expectations of customers, the owner and the environment to the adequacy of all activities performed by the company (Potočnik, 1998). If, for instance, limit ourselves to the implementation of logistics services, each department, division or department is accountable for the implementation of logistics services in its logistics subsystem. The quality of logistics services should not be left to chance, but must be the result of the efforts of all who are directly or indirectly involved in the business system. The company should have developed a model of quality of service (logistics as well), so that we can meet customer expectations or service users. One possible model is a model of quality of service shown in Figure below. Model on the one hand represents consumers, and on the other hand a company that market services. Users on the basis of experience, personal needs and communication with other users forge their own idea of the service - a service expected. On the other hand, the company detects the user needs to be included in their services. It is an adaptation of the user's wishes.

Figure 6: Model of quality of service



Source: Kotler, 1996.

In the model of quality of service several gaps occur[3]. The Gap 1 arises between user expectations and perceptions of these expectations from management. Leadership does not always correctly detect what users want. The Gap 2 arises between the perception of the expectations of the leadership and precise definition of service quality. In this case, the leadership does not determine the correct implementation of the standard. The Gap 3 arises between service quality specification and implementation services. The service is not implemented according to quality standards. The Gap 4 occurs during the execution of the service and external communications. On the users' expectations affect the statements provided by the company's representatives. The Gap 5 arises between perceived and expected service. Users evaluate the performance of different companies and wrongly perceived quality of service. Here we can distinguish objective, subjective and ideal expectations. Strict expectations can be defined by an increased level of quality based on known information. This is the level of expectation of most users. Subjective expectations reflect well-being of users of the service, and also what in their opinion, the quality of service should be. Ideal expectations include what can happen under the best objective conditions.

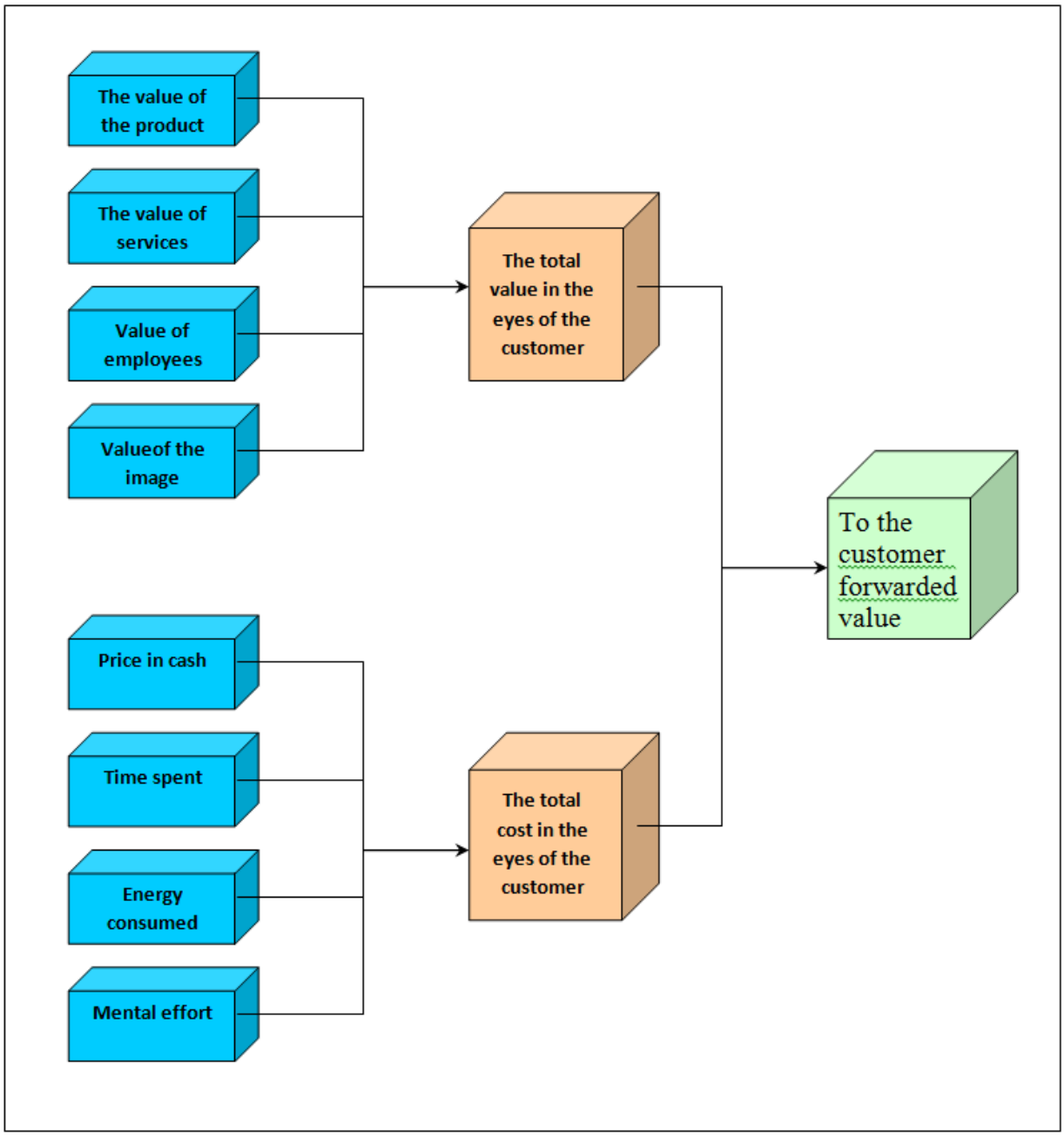
The difference between perceived and expected service can also be defined as the satisfaction or dissatisfaction of service users. Satisfaction is a subjective concept that is inherent or specific to each individual. We also need to distinguish between quality of service and the user's satisfaction. The user

[3] The gap can be described as a gap or inconsistency between the two elements.

perceives or detects the quality on the rational level, while his satisfaction is on emotional level. Satisfaction may refer to the agreement, surprise, joy or pleasure.

Kotler (1996) assumes that customers buy from those companies for which they consider handing them the greatest value. To the customer forwarded value is the difference between the total value and total cost in the eyes of the customer. The total value in the eyes of the customer all the benefits that the customer expects from a given product or service. The total costs in the eyes of the customer are more than just monetary costs. Adam Smith more than two centuries ago, said: "The real price of things involves effort and problems that we have before we get." According to this theory, the total cost consisting of the intended buyer's spent time, energy consumption and mental stress.

Figure 7: Determined added value for the customer



Source: Kotler (1996).

Depending on customer satisfaction we can analyse the product or service at the following levels (Pivka, 2000):

- Generic, basic level: at this level the product or service meets the basic functional requirements. Supplier wants to satisfy and impress the customer with low price.
- Expected level: the product or service is on average, normal level – it offers what most customers expect. Organizations that offer the same level of goods or services must be able to immediately service the customer.
- Higher level - above standard: the product or service is superior; organizations delight customers with higher standards.
- Potential level: the characteristics of products and services that have potential. The development is becoming expected, generated new potential properties.

Successful organizations build management, which focuses on the customer: products and services, and consequently processes are subordinated to the demands and expectations of the customer.
Successful organizations resulting from the following definition quality (Pivka 2000): "Satisfy or exceed the requirements and expectations of our customers and provide a long-term business success!" Consequently, this means that the management of such an organization deals with the following: identifying customer requirements and expectations, tracking development and innovation, customer for them is not anonymous, accompanied by customer satisfaction, business performance...

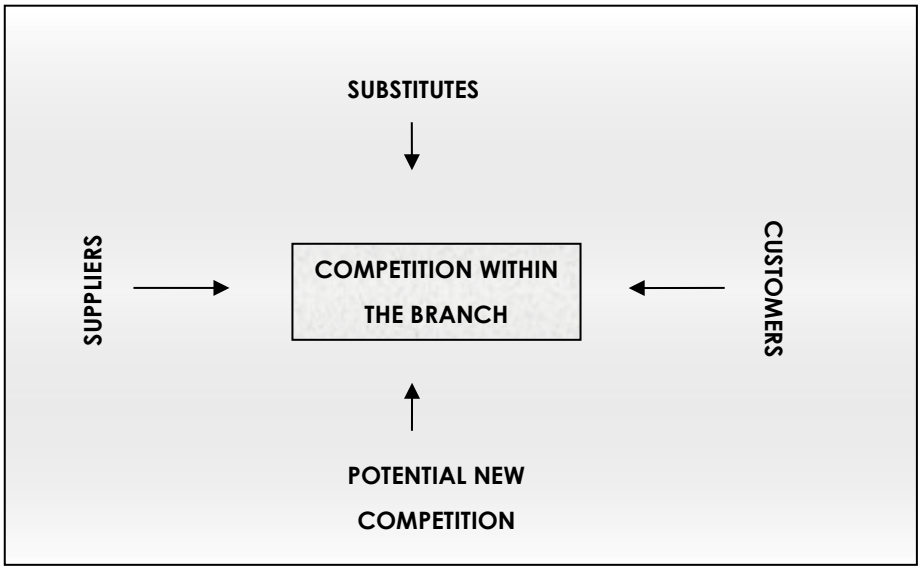
Competitive advantages

Today, when we become the society of continuing competitiveness, not only companies, but also other organizations must have tackled this challenge and at the same time take into account all the changes that are characteristic of today's business and other environment. The characteristic of our time are constant changes, market competitiveness, globalization and time. Companies that want to survive in the market must be constantly adapted to the requirements and changes imposed by the modern market. How and to what extent companies are adapting, depends on each company separately. The more creative the company is, the easier it will survive in a competitive battle. Globalization is an additional threat to the existence of certain companies that are not prepared for a competitive battle. Therefore, it is very important for companies to develop and introduce useful new features that bring them certain competitive advantages. Innovation has become the most important competitive advantage.

At the forefront of the competitiveness of enterprises it is necessary to highlight and present the Porter model of competitive forces. In the model five different competitive forces operate:

- competition within the branch of the company,
- suppliers of the company,
- customers of the company,
- substitutes, and
- potential new competition.

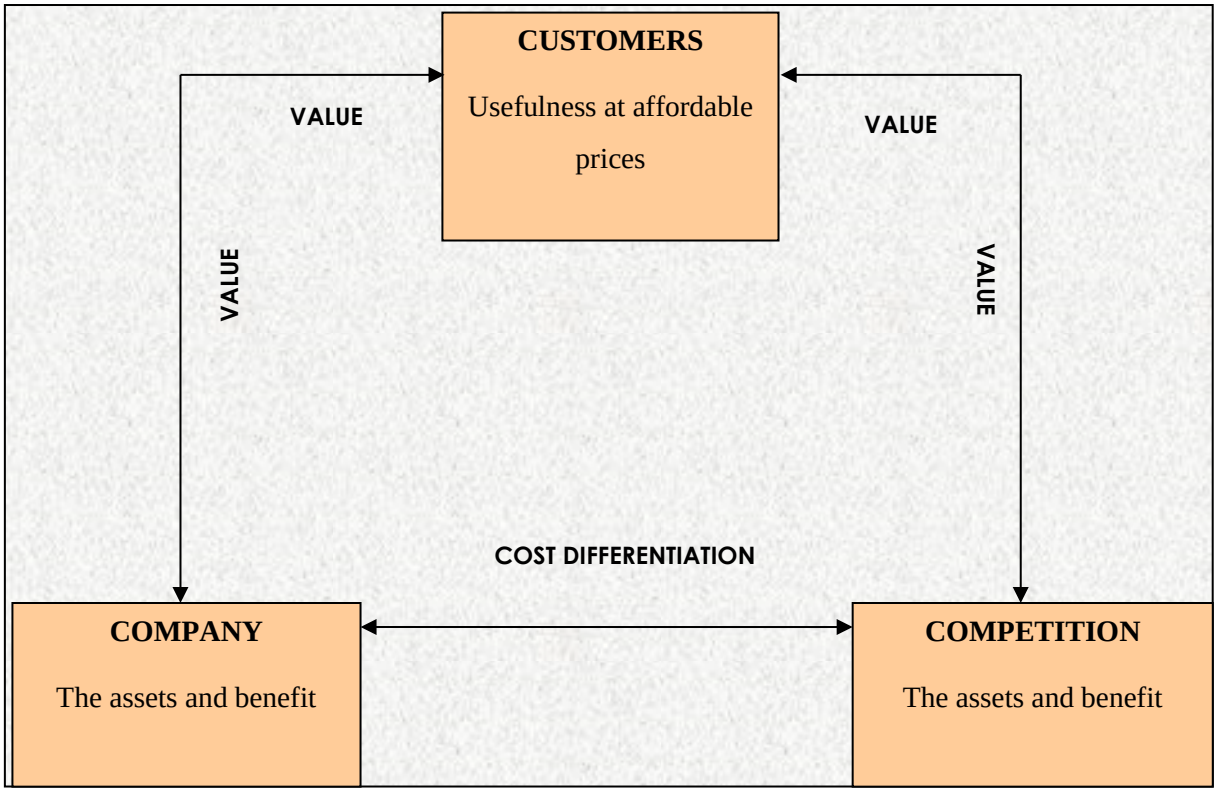
Figure 8: Porter model of competitive forces



Source: Porter (1985).

Performance of the entire supply chain is provided through all phases, from purchasing market to the sales market. Logistics and logistics processes can have a significant impact on competitive advantage, where value chain can be created through economical logistics flows, and which on the one hand, satisfy customers, on the other hand has a positive impact on the suppliers. In the integral supply chain is necessary to provide links between businesses, customers and competition.

Figure 9: Market achievement of the value



Source: Adapted from Christopher (2005).

Competitive advantage can be achieved by:

- cost-effectiveness, and
- value-added product or service.

Cost-effectiveness requires cost management, with a focus on logistics costs. The basis of cost management is the optimal planning, management and monitoring of costs. Wherever runs the business process, it is closely connected with costs. Costs are price-expressed costs of production resources. In business enterprises, each member of the company has greater or lesser impact on the level and the reasons for the emergence of costs. There is obviously a difference between the impact of the one who is preparing technical proposals for the management and governing bodies of companies and their most important decisions on operations, and between those who prepare goods for storage or removal. However, the both of them, as well as everyone else in the company, can cause or prevent costs and thus affect the existence, development or failure of a company, its job and its own life. Smart companies are very vigilant when deciding about costs. Every moment of working or not working is therefore associated with the generation of costs.

Their height depends primarily on the impact of three factors:

- consumption of raw materials, energy, wear and tear of machinery and other equipment, and the use of working time – in short, of the use of business process elements,
- optimization of logistic processes, and
- the purchase price.

We permit the generation of costs in order to sell products and services, because we assume that the market for their consumption of solvent demand exists. With the selling price of products and services on the one hand the total income to cover the costs and design funds is achieved, on the other hand the costs will be paid by our customers. The higher costs we will cause to them, the higher costs they will cause to end customers. At the end of this chain the higher costs will again affect us as well. Therefore, we are interested in minimizing costs, since this enables us to maximize the difference between total revenue and the price of our products or services. This allows us the lowest possible purchase price of elements of the business process. This is a goal to which we strive in the business of each company.

Costs and operations

The market is not only the most important link of company and the environment, but also a necessary precondition for the existence of the company in its current form. Prices of goods and services that we sell and buy in the market depend not only on the cost of production of goods and services, but also on the position in the market. This also shows that there is no viability of a business enterprise depends only on labour productivity, economy and rapid circulation of assets of the company (= turnover ratio), but also on the circumstances in the market.

<u>Logistics costs</u>

Logistics causes the relative and absolute very high cost. The proportion of logistics costs in the total cost of the final production in the United States hovers around 60% and in Western Europe at 54%. This rate varies according to the individual economic branches.

When comparing the share of costs for individual countries, we need to find out which costs are delivered as logistics costs by different companies. Tracking and analysing costs is therefore very important activity in logistics. In theory, we analyse the logistics costs in relation to the area where they are generated.

In terms of the basic concepts of logistics, logistics costs can be defined as:

- acquisition costs,
- transport costs,

- internal logistics costs,
- storage costs and inventories,
- distribution costs,
- costs of logistics and after-sales, and
- other costs incurred in carrying out logistics activities.

The global logistics industry is approximately 5.4 trillion or 13.8% of world GDP. This means the annual logistics costs in Europe and North America of around 1 trillion Euros. Logistics costs represent on average 10 - 15% of the final cost of the finished product. This includes costs such as transportation and storage.

Macro-environment – PESTEL

Globalization has become synonymous with liberalization, greater economic openness and accessibility to all world markets, which are (synergistically) more and more merging into the global market. Parallel to this trend the needs of markets and consumers are changing (faster and faster). How to cope with this trend is the very "essence", which demonstrates the quality of organizational and business systems and their ability to respond to changes in a comprehensive manner. Various modified business situations are intertwined with the problems that need to be addressed, but cannot be managed or resolved easily, as they are often not easy. The practice is proving to be constantly faced with increasingly large and complex problem situations that cannot be (relatively easily and without adequate knowledge) addressed with the known methods and models.

Competitiveness of Economic Entities

Companies are crucial for the effective market economy. Successful companies have secured a significant competitive advantage, which is a feature that allows the company to do business better than the competitors.

The key factors of competitive success are those that bring companies an advantage over competitors in the market.

A variety of competitive forces affect companies (Rebernik, 1997):

- Intra-industry competition and rivalry of the existing companies,
- Potential new competition and a threat with its entry in the market,
- Customers and their economic power,
- Substitutes and a threat of substitution of products and services,
- Suppliers and their economic power.

Above all, own knowledge, and innovation and development orientation of the company create the conditions for occupying the leading position in the market. Ideas that arise within the company often respond to specific problems within the company or are related to its core business. If a company decides on planned own invention and innovation activities, the funds earmarked for modernization remain in the company. Own invention and innovation activities comprise small everyday inventions and innovations as well as those that provide for the basic vision of development of a company. In other words, creative thinking is not limited by administrative allocation of operations within the company, but companies need to develop creative thinking in all their employees. So, this is not just the domain of a small circle of development experts, but it is necessary to create the conditions that enable and support invention and innovation activities in every business segment (Likar, 1998).

At foreign sources it comes to buying foreign knowledge, to acquiring industrial property rights, technological knowledge by purchasing a licence, to purchasing technology-innovative enterprises and to imitate and copy. It is necessary to properly motivate the employees for creative work in the

company. It is, however, not important whether own or foreign resources are used, but the emphasis should be on comprehensive and systematic thinking. Innovative business is an innovation of the management, which should facilitate innovation management in all organizations, whatever their size or a business object. Innovation must be part of the organization platforms, on which bases guidelines for its operation and development are drawn up. Companies that have adopted this mind-set are more successful in practice than others, which are still operating under the routine procedures. Certain characteristics of these successful and innovative companies are also shown in table below.

Table 2: Characteristics of successful and less successful companies

More successful companies	Less successful companies
1. Action-oriented, early implementation of decisions	1. Long-term analyses, complex decision processes, endless debates
2. Close to the buyer, good knowledge of users and their needs	2. Exotic products, tinkering and ignoring the needs
3. Productivity by mobilizing creative people	3. Strict control systems, abundance of prescribed documents
4. Autonomy, decentralization, corporate entrepreneurship, promotion of entrepreneurship and experimentation	4. Central guidance and intervention, avoiding experiments, the apparent support of autonomy and decentralization
5. Simple organizational structure, little management and few headquarters	5. Complex structures, many hierarchical levels and coordinating bodies
6. Focused on the controlled areas, clear corporate identity	6. Diversification into the unknown, no synergy
7. Leadership by example, integration of management with operators	7. Keeping the distance, decisions are taken at the administrative level
8. Corporate culture rather than bureaucratic regulation, common values	8. Everything or nothing is prescribed

Source: Mulej (1994).

For the company it is best to have as many features of successful business as possible. Surely, any company should strive for effectiveness and sufficient competition in the market. Larger companies easier dispose of more resources to the process innovation because of better financial resources, but also small firms dispose of part of their resources to innovation (During, 1998). Small businesses are important, because of their encouraging entrepreneurial activity, which affects the national economy (Zoltan & Audretsch, 1993). This largely depends on the management and other employees, which are necessary to create an appropriate culture of innovation. In an innovative business company, it is necessary to consider the social environment, as well, and the innovation platforms, that significantly affect the processes of innovation in the enterprise. The company should be focused on the integration of a managerial, information and fundamental process.

4 Innovation for a value added chain

Growing individualisation of the society, particularly in industrialized countries, is a trend that is only virtually in contrast with the globalization trend. While globalization gives an impulse to the balancing and integration of regional disparities, an increasingly individualized pluralistic society is co-developing with rising standards. A man saved from economic necessities or political suppression attempts to achieve his own realization, which he will also achieve if he can afford it. A man strives to accomplish his individual preferences and needs. The same applies to the entire cultural community, which is gaining on the national significance with the increased globalization. Individualization leads to a

pluralistic society with many specific problems. An organization - the tenderer should make arrangements to perform services that are specific to the wishes of individual users, i.e. flexible manufacturing and customer- oriented business logistics, allowing for the transformation of domicile products to the consumer's specific products by means of transfer and communication. Thanks to the business logistics the organization can manage this megatrend by the differentiation strategy.

Strengthening the competitiveness is the task of every company that wants to be present in the market for a long time. Management must take care to maintain the company's position in the market. Top managers are investing heavily in developing new products, as this is the only way successfully to conduct business. If the manager is not a business owner, he can get a well-established reputation by proving himself as a good leader, which allows for his successful business career.

There are various programmes to maintain and enhance competitiveness. Mihelič (2001) presents the key conditions for increased competitiveness:

- Promoting entrepreneurial ventures,
- Strengthening R & D departments in companies,
- Development of joint R & D infrastructure,
- Increasing technological complexity of products and services,
- Transfer of knowledge, research results and new technologies from universities and institutes in economy,
- Promoting international scientific and technological cooperation.

Initially, innovation was separated for technical-production and economic-organizational issues. However, it is becoming increasingly clear that cooperation of both is essential. In order to be more successful at introducing management technology in companies, companies should be working on developing an interdisciplinary approach, based on creative innovation collaboration of economists and engineers.

The entrepreneur and entrepreneurship are fundamental to the process of technological development, because they are introducing the potential innovations in the economic practice. It is also important that managers in companies are willing to invest substantial means into research, because companies cannot exist without innovation in the long run. The essence of modern systems is an innovative orientation and an innovation-friendly environment.
Possible Strategies at the Introduction of New Products or Services

Considering only pricing and advertising as the most important factors of introducing a new product or service, companies can decide between the following four strategies:

- Strategy of "rapid cream skimming"
- Strategy 'of slow cream skimming"
- Strategy of "rapid market penetration"
- Strategy of "slow market penetration."

In practice, the company's new product or service is usually offered to customers who show the greatest interest and have the greatest purchasing power at the same time. Accordingly, the most commonly used strategies are those of higher prices and "cream skimming".

Figure 10: Market approach to introducing new products or services

	ADVERTISING	
	Strong	**Weak**
High price	**Rapid "creamskimming"**	**Slow "cream skimming"**
Low price	**Quick "penetration of the market"**	**Slow "penetration of the market"**

Source: Potočnik (2000)

If the introduction of a new product or a service was successful, it would be followed by the growth and expansion of sales.

At the time when customer demand is growing, a growing number of competitors are entering the market; however, the gains are still going up due to the increased demand for the product or the service.

The company can choose between the following strategies:

- To improve the quality of the underlying product or the service and provide additional services;
- To enter in the new market segments;
- To select new marketing channels;
- To promote advertising;
- To reduce the price of the underlying services, thereby attracting new customers with lower purchasing power.

When the sale of a product or a service does not grow anymore, a company has achieved the degree of maturity of this service. Increased sales of the same service are possible only in new markets. The company can help with promoting activities, aimed at potential customers of services.

The degree of service maturity lasts for the maximum time period and occurs in three stages:

- Sales growth rate begins to decline;
- Saturation of the market occurs – the sales stop;
- The absolute level of sales is deteriorating; consumers are turning to the competition.

Strategies that a company may use at the degree of maturity are:

- Changes in the market strategy – the company attracts customers who have not used the services until now; the company enters the new market segments and identifies market niches, obtains the customers of the competition.
- Changes in the service strategy – the company improves the quality of services or introduces additional, new services.

- The strategy of changing the marketing mix – price adjustment, commercial discounts, improving the supply of services by intermediaries, advertising, sales promotion, introduction of personal selling.
- The reasons for the poor sales of certain services may include: technological advancement, launching new services, changes in trade flows, outflow of cargo to a competitive carrier, etc.
- Companies must establish the outdated and unprofitable services, and develop an appropriate strategy for the removal of any such services.
- The decisions at this level may include:
- Continuation of the production if it is still possible,
- Divestment and co-investment in attractive market niches,
- Removal of obsolete services.

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 CO2. Some organizations directly emit other GHGs.

Thus, for example, in the production of certain chemicals methane (CH4) is produced, in the use of nitrogen fertilizers nitrous oxide (N2O) 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 CO2 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 CO2 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).

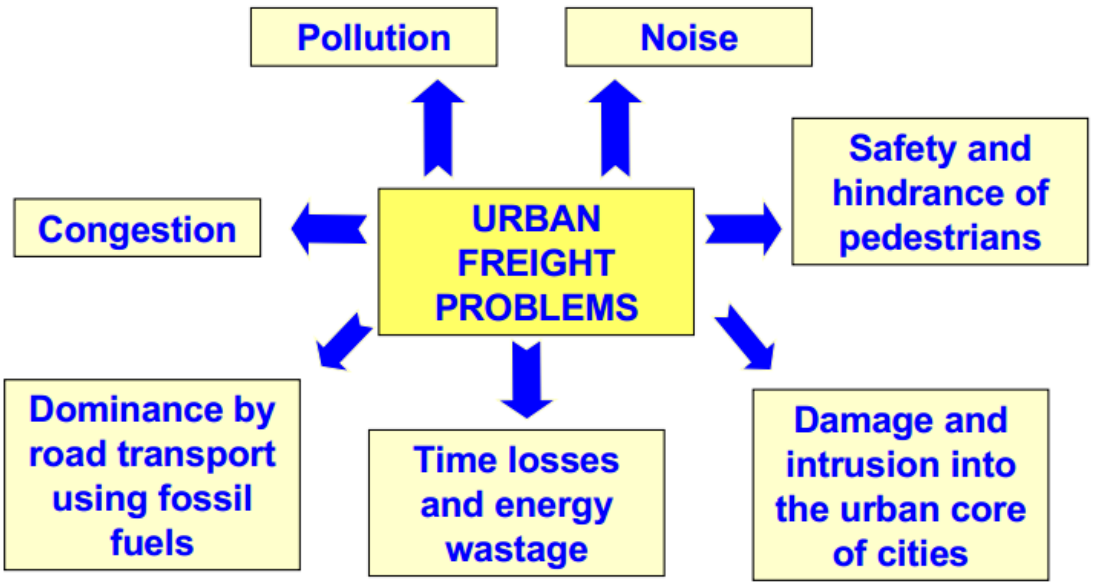
The limited transport infrastructure and space: Transport infrastructure is overloaded and the possibility of its extension are limited, as the limited space to build. Thus, it is difficult to deliver and stop in cities, as in the time of discharge major traffic congestion can be caused. The losses due 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).

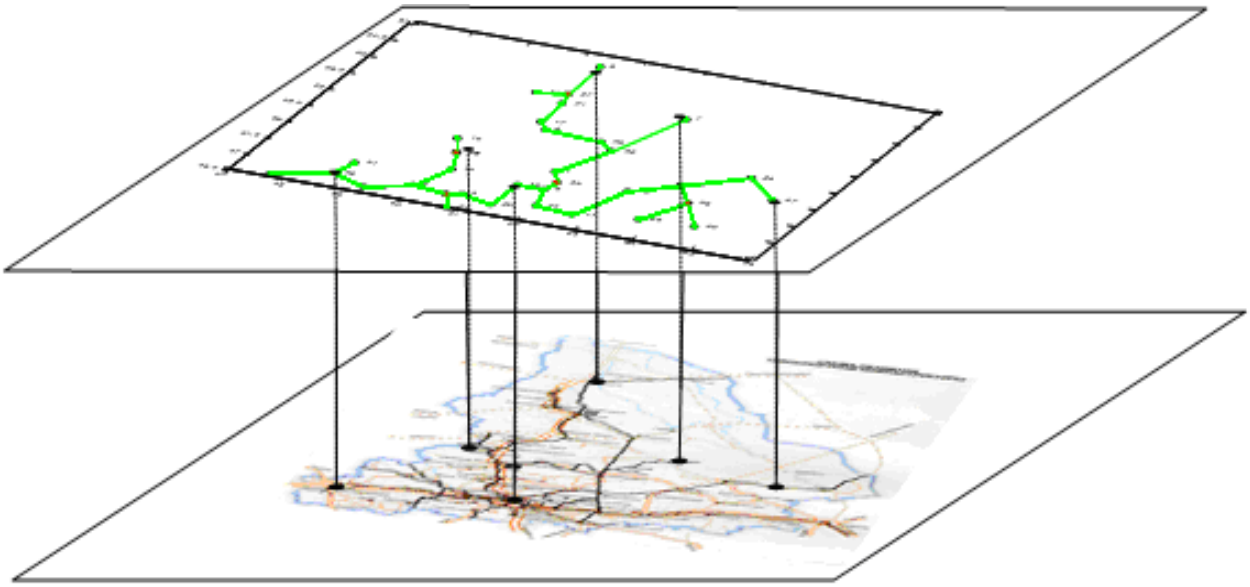
Russia - a major energy state. Two-thirds of exports accounted for oil and gas. However, in the global markets demand for primary energy and raw materials falls, and the demand for alternative energy sources, in particular, for biofuels - is growing. It is expected that by 2020 the European Union level 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.

Transport

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Traffic growth is strongly fuelled by economic growth, because without an efficient transport system the internal market and the globalization of trade cannot fully be exploited. The growth of traffic is affected primarily by two factors, namely in the passenger traffic by the increased use of cars, whereas in freight transport the traffic growth was affected by changes in the economy4.

The economic growth will lead to increased need for mobility; it is estimated that demand will increase by 38% for freight transport services and by 24% for passenger transport (European Commission, 2001).

1 Introduction

We must realize that economic development is closely or even symbiotically linked to the efficiency of the transport system, so the society must provide for the consistency of its operation. In other words, it is necessary to ensure sustainable development of traffic flows in both goods and people, which should be adapted to the needs of a modern economy in a comprehensive enough manner. We should not ignore the wishes of the people that subordinate the choice of modes and directions of transport to their own needs or ways of life. Contemporary practice also shows that people combine transport modes because of the optimization of logistics, i.e. shorter transportation time, cost reduction, utilization of space accessibility, environmental effects, etc. Therefore, today, passengers and cargo are transferring from one transport system to another one.

In addition, we must be aware of the impacts (especially of the negative ones) of the transport system and be able to foresee them. Traffic growth require a comprehensive traffic management due to increasing needs, which are a result of increasing population mobility on the one hand, and of the all-encompassing rationalization of operations of organizational and business systems on the other hand. This is especially necessary because of disproportionate or unsustainable development of certain transportation subsystems and their impacts on the deterioration of the desired quality of life.

In general, the effects of traffic are divided into 2 groups, namely: (1) direct effects, which relate to better access to markets due to the shorter transport times and lower costs for transport providers and for direct users of transport services, and (2) indirect effects, both at the level of an individual (greater choice of goods, lower prices, a land rent), a country or a region (improved competitiveness, greater mobility, the creation of distribution networks, etc.).

The improved railway transport infrastructure contributes to a greater traffic capacity and greater efficiency and reliability of transport infrastructure (i.e. the reduction of the traffic risks, which is

[4] In the last twenty years there was a shift from the economy of "stocks" to the economy of "flow". This phenomenon was highlighted by the movement of some activities (especially of manufacture of goods with high labour input), which aim to reduce the production costs, although the place of manufacture is hundreds or even thousands of miles away from the final assembly plant or users.

especially important in times of integration of individual production and delivery systems in the supply chains).

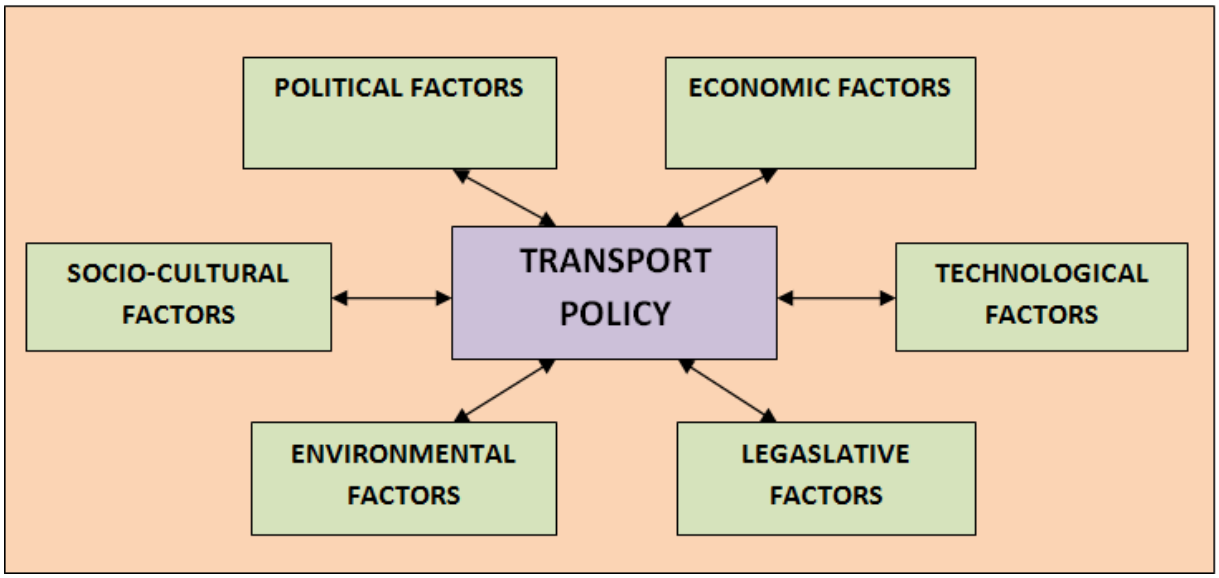
Transport or the degree of its development is directly linked to the development of the national economy, which either stimulates or inhibits it. In the reproductive process transport enables the integration of production and consumption, a more rational use of production factors, i.e. consideration of the comparative advantages of individual countries. Transport mainly influences the social division of labour, which is reflected in the changing economic structure of the national economy, the influence of which is shown in the regional economic development of each country.

The transport system is an important part of economic development of each country. Mobility is a basic and important characteristic of economic activity, providing for the essential need to change the location of passengers, cargo and information. All economies do not provide for the same degree of mobility. Economies with higher levels of mobility are those that have better economic and social opportunities for the development of transport technologies and infrastructure.

2 Transport Policy Positioning in the Macroeconomic Environment - PESTEL

The transport policy can be positioned by the PESTEL method (Political, Economic, Socio-cultural, Technological, Environmental and Legal), i.e. taking into account the political, economic socio-cultural, technological, environmental, and legal factors (adapted from Hrastelj and Brenčič, 2003, 28).

Figure 15: Transport policy positioning



Source: Adapted from Sternad (2008)

Political factors

Traffic and the transport policy significantly influence the employment policy as a macroeconomic category; they have a major impact especially on the taxation and customs policies, just as transport is the main part of the public revenue. Transport policy requirements for modern means of transport associate the transport policy with the modern information solutions, as well as with the research and education centres.

Economic factors

The transport policy is an important part of the economic environment of each country. As the very sector, which is significantly correlated with the economy and which has a major influence on the

development of individual countries, it is also an important indicator of economic trends in the country. The transport policy in its guidelines and measures significantly impacts the macroeconomic environment. The criteria for monitoring the macroeconomic environment include the GDP, the GDP per capita, the unemployment rate, the purchasing power parity, the trade balance, inflation, the currency stability and others.

Given the great importance of transport for the economy it is not surprising that transport significantly impacts the size of GDP. The development of the transport infrastructure, which is one of the fundamental requirements of the transport policy, influences the development of the national economies and economies of individual regions. The requirement of a modern infrastructure lowers the unemployment rate of the population (the need for construction workers) and facilitates the development of individual industries (tourism, catering).

Socio-cultural factors

The transport policy as part of the social and cultural environment [5] should take into account the importance of habits and customs of a society and its willingness to accept a certain political will. The transport policy, particularly in limiting the road transport, contributes and requires changing the habits of a particular population on the one hand, and promotes healthy[6] ways of transportation of people and the increase in traffic safety on the other hand, which have a significant impact on the social development of the population, demanding changes in the behaviour of certain road traffic participants.

Technological factors

The technological advancement is one of the main factors in the development and creation of new markets and in restructuring the existing ones, and is one of the drivers of growth in international competition. The development of information and communication technologies has enabled the development of electronic services and modern technology means, which have a significant impact on the economic development of each country and on the macro-economic categories. The transport policy, with the assistance of modern information systems, is geared towards managing traffic growth. The development of modern means of transport allows for better and above all environmentally friendly future; in terms of the national economy external costs are reduced, which are generated by the negative effects of individual transport systems. In particular, high health care costs should be exposed, counting for a large proportion of the national budget.

Environmental factors

Environmental factors are increasingly topical and also binding, cover mainly popular attitude towards the environment, protection laws, and energy consumption regulation. Environmental factors include weather, climate, and climate change, which may especially affect industries such as tourism, farming, and insurance. Furthermore, growing awareness to climate change is affecting how companies operate and the products they offer – it is both creating new markets and diminishing or destroying existing ones.

Legal factors

[5]Culture is a system of meanings (values), common to all members of a community or a society, which determines what to pay attention to, how to behave and what to appreciate. Culture is not inherited, but learned. It is also not characteristic of an individual, but of a group of people.

[6]A particularly healthy way is to promote walking and cycling.

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The transport policy as part of the legal environment is designed and implemented generally on the basis of various directives and policies adopted nationally. National transport policies and guidelines provide for legal acts allowing for the implementation of the transport policy.

The impact of "PESTEL factors" on the transport sector of Russia on the example of JSC "RZD" (open joint stock company "Russian Railways")

Political factors, in particular the state regulation of tariffs affect the formation of tariff policy of JSC "RZD", there is a direct state regulation of this process. During the global financial crisis of 2008-2009 and financial instability of Russian enterprises at the state level, we have introduced stringent restrictive measures of tariff regulation in the Federal rail transport, which is expected to cross-subsidize industries at the expense of rail transport. Government price policy affects the company's tariffs, and, therefore, the pricing and the company's budget, the salaries of employees, the system of incentives and bonuses. Possible reform of the tariff policy, including the waiver of cross subsidy, will have an impact on the financial position of the company. The company is negotiating with the Government of the Russian Federation on the formation of tariffs for services of the company, about the increased tariffs (http://ir.rzd.ru). Changes in the political situation, legislation, taxation and regulation affect financial and business activities and profitability of the holding company. The nature and frequency of such changes and the associated risks, are generally not covered by insurance, as well as their impact on future activities and the profitability of operations is unpredictable. Regulatory (network) contract governing long-term relations between the state and the infrastructure owner of the holding will remove restrictions of funding necessary activities. State support of the society is also one of the factors of influence in politics. Basically, government subsidies and investments designed to cover operations and to solve national issues on the development of the railway network that does not lead to additional profits of the company.

The priority areas in recent years in reforming the railway transport of the Russian Federation were:

- creation of conditions for the completion of formation of the market of operating freight trains;
- improvement of the regulatory and tariff conditions operation of railway transport;
- sale of shares part of the subsidiaries of the holding company;
- completion of suburban passenger companies and the creation of conditions to ensure the profitability of their activity;
- the reform of the remaining complexes of non-core assets;
- creation of joint companies in promising segments of the railway market and related to rail transport businesses.

Economic factors such as GDP, inflation, costs for energy, raw materials, utilities, suppliers ' prices increase, specifics of production, seasonality also affect the pricing system to encourage staff and staff salaries. But the most powerful is the impact of consumer demand for freight transport, as this type of service is most profitable company. The slowdown in growth in the traffic volume and, consequently, loss of income of the company lead to anti-crisis measures, including reducing the costs of the holding company, including optimization of pay for staff (http://www.rzd-partner.ru). Nevertheless, occur in the country's economic reforms, developing the legal and tax system. Russia's economy is exposed to market downturns and economic slowdown in the world economy. The effects of the global financial crisis may affect the value of fixed assets of the company and financial results. In particular, this is evidenced by the analysis presented in the annual report 2011 of the President of JSC "RZD" holding activity in segments of infrastructure and freight transport, since 2004, shows that one of the main factors affecting the position of Russian Railways, is the growth potential of the turnover on the basis of projected economic growth. This factor affects the need to ensure conditions for the increased

service needs of consumers in freight transport. However, the situation in 2013 showed that the rate of economic growth declined, respectively, and slowed the growth of cargo turnover of Russian Railways, and this factor has acquired a negative assessment for the activities of the holding. In the structure of economic factors also include - taxation. Russian tax, currency and customs legislation is subject to varying interpretations and changes occur frequently. The interpretation of the management and employees of the legislation in the field of taxation with regard to reporting RZD may be challenged by local and Federal authorities who may be taking a more assertive position in tax examinations. As a result, incur significant additional taxes, penalties and interest. As at 30 June 2012, the existing reserves of the holding cover tax liabilities. The holding companies are involved in litigation arising in the course of conducting financial activities related to the application of tariffs for transportation.

Technological innovation is one of the important factors for the company. Factors such as technology access, licensing, R&D trends, new patents, new products, technology development, development of innovations in transport, replacement technologies, research funding significantly reduce the company's expenses, create substantial savings. From the introduction of new technologies depends on the state of the Railways and transport companies, the level of customer service, the prestige of the company, and, consequently, the incentive system for employees who appreciate the company's brand, its image and the importance of direct work in the company. The inevitability of the introduction of new materials and technologies, ensuring efficient and safe operation of the railway network, justified competitive struggle for the consumer in the transport market and the market of services provided by the infrastructure of the holding. The purpose of innovative development of the Company is to achieve high economic efficiency, ecological and functional safety and sustainability of rail transport, as defined in the Strategy of development of railway transport in the Russian Federation until 2030. The Company has formed a structure and implemented a corporate system of management of innovative activity. Joint development of JSC "Russian Railways" with foreign and domestic companies allow you to create new models of rolling stock, technical infrastructure funds with performance on a global level. Such technological factors like communication and the Internet has an impact on the processes of storage, use and transmission of information. The holding has introduced its own internal system of information exchange - intranet and video conferencing systems, audio conferencing, conference calls and many other information systems that are focused on specific functions of roads, departments, directorates, departments, managers, professionals. An effective system of communication leads to increased motivation of staff through improved comfort in the workplace.

Socio-cultural trends have a strong influence on the incentive system of the company. Changes in the underlying values, changes in the style and standard of living, attitude to work and leisure have a direct impact on staff motivation, incentive system and salary system in the company. The influence of the media has a constant impact on the reputation of the company. The company is quite often reported in the press. Brand, company reputation has an impact on investment activity in obtaining grants and other investments in the projects implemented by the company of innovation of innovations in the field of railway transport, the latest production technologies. On the perception of customers and partners as a strong and reliable player in the market, and the potential of the specialists of the holding as the main employer is affected by the process of rebranding. Begun in 2003, a re-branding process, when the company got its name - OAO "RZD", continues today in the form of structural reform of railway transport, improve the quality of transport service, change of corporate identity. The transition to the new corporate identity highlights the new status of "Russian Railways" - market structures.

The mass media have an impact on the process:

- introduce people to new content for the brand;

- underscore strong and confident position for the company's partners;
- the involvement of professionals and young specialists to work in the company.

On the company's activity is influenced by climatic conditions, geographical position of the structural units. Of particular importance Railways is also determined by long-range transport, poor communication other transport modes in the regions of Siberia and the Far East, the remoteness of the places of production of the main raw material resources from their points of consumption and sea ports (http://rzd.ru).

The greatest impact from the macro-to the company have a policy factors. The policy of state support for industry, Federal tariff service, the government of the Russian Federation, Federal tax service, Federal Antimonopoly service. In a situation of economic crisis complicated the procedure of decision making at the strategic level by containing government necessary for the profitability of the company's assets on transportation tariffs. Among economic factors have the strongest influence does the effective demand of consumers. Because this factor depends on the formation of the profits of the company, financing the introduction of new technologies. From the same depends on the formation of the wages Fund, the adoption of the budget. Big enough impact: energy prices, the level of monetary income of the population, the cost of the enterprise. These factors affect the pricing of the company to profit. The introduction of new technologies affects the efficient, safe and profitable operations of the company. Thanks to the introduction of new products, increases the level of technical equipment of the company, improving the production process, increased technical competence of the staff.

The influence of environmental factors on the activity of the holding depends on the type of environmental-economic development of the country. Technogenic type of economic development involves a dangerous road features. Such as: washing and steaming items for bulk rolling stock, sanitizing stations wagons for transportation of animals and biohazardous substances sleeper impregnation and macadam plants, locomotive and wagon depots, rolling stock, carrying oil and explosives. Improper operation of facilities provides for administrative and financial responsibility (Economics of railway transport, 2006)

Reducing the harmful impact on the environment is carried out in the establishment of the state environmental standards and regulations such effect. The rules are: maximum allowable or temporarily agreed emissions into the atmosphere of harmful substances (MPE, ne); maximum allowable or temporarily agreed standards of effluent into water (MPD, BCC); the maximum permissible load of waste production on land and soil (MPE); the maximum permissible concentration of harmful substances in air, water, soils (MPC), etc. The investment activities of environmental protection on the objects of the railway needs to direct state support in the form of subsidies from the state budget.

The efficiency of railway transport in Russia due to the use of electric traction, which has no harmful effects on the environment, besides due to the effect of the scale of transport this type of transport consumes less energy resources (http.doc.rzd.ru).

Environmental management in JSC "RZD" involves:

- reducing the harmful impact on the environment;
- reduction of emissions of harmful substances into the atmosphere from stationary and mobile sources;
- the reduction of greenhouse gases;
- reduce discharge of polluted wastewater into surface water bodies;
- the increase in the share of utilization and disposal of waste from General education.
- the development of appropriate regulatory documents;
- develop optimistic, conservative and pessimistic variants of the environmental strategy development;
- reducing the level of noise impact on the environment;
- liquidation of consequences of land contamination;

- bringing waste into the economic turnover as additional sources of raw materials;
- implementation of best available environmental technology uses and disposal of waste.
- improving energy efficiency;
- increase industrial environmental control;
- rational use of natural resources and energy.

Macromedia is represented by a set of micro-factors. Factors in the microenvironment of the holding JSC "Russian Railways" have a direct impact on the company's operations, and relates to the operations and processes of the business units. First of all, the direct factors of influence are: suppliers, consumers, competitors, public institutions and institutions of production and social infrastructure. The competitive environment of the company is: competitors, suppliers and customers of the holding company. Competitors include firms selling to the same markets products that meet the same needs. Competitors holding to meet the needs of consumers in freight transport, providing transportation services on the territory of the Russian Federation - are transport / logistics, automotive companies, companies providing services to the Maritime, inland waterway, air and pipeline transport. According to Rosstat data as of 1 January 2012 in Russia there are 163261 the company providing transport services (http://www.gks.ru). For JSC "RZD" competitors are not only a danger, but also create conditions for business activity of the company, forcing him to constantly look for new solutions, and the diversification and development of production.

For example, the company has an experience of participation in the activities of the multidisciplinary trading port in Ust-Luga, construction of port facilities, rail approaches to the port. The presence of a 25% stake in the port of JSC "Ust-Luga Company" gives you the opportunity to participate in the development of port infrastructure, as well as to influence the tariffs and to establish effective rate pass-through to shippers, as well as to implement the strategy of multimodal transport, thereby to profit from the share of Maritime transport (http://www.rzd-partner.ru). In particular, in the Siberian region, the number of organizations that provide transportation services, is 21815 enterprises.

The main indicator that demonstrates competitive advantage in the industry of freight shipping is a freight turnover. According to Rosstat, the freight turnover in Russia in 2012 increased by +3.4% compared to 2010 and amounted to 4 915,3 billion tkm, the data presented in table 4. The structure of cargo turnover is formed directly specialization areas, the mix of industries in the region, the distribution processing industry. Specific region generates its own traffic pattern, and, consequently, the ratio of traffic through a variety of transport.

The most congested areas of the country are:

- communication Center with the Urals, the Volga region, the North-West;
- connection of the Caucasus, the Volga region and the Urals;
- connection of the North-West of the Urals;
- connection of the Urals and Siberia and the Far East.

The passenger traffic of Russian Railways group in 2012 amounted to 144,6 billion tariff passenger-kilometers. This indicator during the analyzed period also has a positive trend.

The next factor environment direct impact on the company is the suppliers that provide the input necessary for its functioning resources. Since 2007 the company has entered into several long-term contracts for the purchase and maintenance of locomotives, trains, rails and other equipment with Russian and foreign suppliers, including contracts with related parties, totaling 498 699 million (including 1 690 million euros (69 830 million rubles at the exchange rate on 30 June 2012) and 406 million US dollars (13 324 million rubles at the exchange rate on 30 June 2012)) (http://ir.rzd.ru). The total value of contracts with related parties amounted to 214 327 million rubles.

The amount of the commitments under these contracts as at 30 June 2012 Amounted to 386 740 million rubles (including 1 312 million euros (54 211 million rubles at the exchange rate on 30 June 2012) and 91 million USD (2 986 million rubles at the exchange rate on 30 June 2012)). The amount of obligations under agreements with related parties at 30 June 2012 Amounted to 162 229 million rubles. The company has long-term contracts for the construction of a combined motor and Railways and other infrastructure in Sochi totaling 279 522 million rubles. The amount of the obligation under these contracts at 30 June 2012 $ 187 613 million rubles.

The vendor group holding company, first of all, it is advisable to include suppliers of material resources: raw materials, components and energy. The impact of suppliers on the company is that they form a sort of resource dependence, the strength of which depends on the specific resource market. Relationships with suppliers are of a contractual nature. However, given the resource classification, which include the company's core resources human resources and human capital to providers include schools and colleges as providers of human resources. Great value for the research they are both young professionals as human resources of the company are the direct subject of study in this work.

The largest provider of human resources for the holding company "Russian Railways" are: universities, polytechnics, colleges of specialized areas. So human resources emerged as a very special resource holding. The quality of the relationship between structural units of the holding with educational institutions (suppliers) depends on a number of parameters:

- the level of specialization of the supplier;
- the availability of alternative suppliers of similar resources;
- the territorial disposition of this or that educational institution from the holding unit;
- the presence of the target program specialists training;

Of particular importance is the nature of relationship holding company and suppliers' long-term nature of cooperation is evident not only in the presence of target programs of student learning, but also in the reverse process, namely in constant communication universities and colleges with relevant departments, in a continuous process of improvement of qualification of teachers. For holding the most favorable situation close cooperation with educational institutions, as in this case, there is a high probability of receipt of the relevant request of the labor resources that potentially should lead to significant savings, improve the quality of services of the holding company and to accelerate the market entry for new products.

In favor of the fact that in this case the activity of the holding providers of human resources have a strong influence, indicated by the following aspects:

- suppliers are narrowly specialized educational institutions in every region of the country are one or two supplier of specialists with secondary and higher professional education;
- the costs of changing suppliers are large enough compared to the savings that can be obtained from this shift.

But, nevertheless, it cannot be said that the holding is not an important customer to the supplier, as educational institutions deliver highly specialized resources. Relationship holding company with suppliers of material resources, as well as works and services are tender in nature (http://rzd.ru). In 2011 it held 16979 bidding. JSC "RZD" is constantly seeking for new management practices and reforms at the micro and macro level. Interaction with suppliers on a competitive basis is cost-effective. When choosing a supplier with tender RZD developing key indicators of the tender for the selection of enterprises satellites, which compete for the right to participate in the execution of orders for the holding.

Tenders have been held since 2005 in various activities, most of which are associated with the process:

- the supply of technological equipment;
- repair of technological equipment and transport;

- technological works;
- design and survey (PIR) and construction (CMP).

Consumers holding serve individuals and organizations: citizens of Russia and other countries, trading companies, industrial enterprises, including mining and processing natural resources, physical and legal persons, companies, individual clients, the state, the facilities provided by the infrastructure services holding company. The specific composition of consumers depends on the scope of activity of the entity's holding, the characteristics of products and services, or infrastructure activities, scale of production, structural divisions and subsidiaries, markets and territorial factors.

For each client using transport holding important the following factors:

- reduction of queues for tickets;
- comfortable travel;
- flow acceleration when sending cars;
- Internet-buy tickets.

The holding company also cooperates with foreign clients. JSC "Zarubezhstroytehnologiya", 100% subsidiary of the holding company entered into a series of long-term contracts for the construction of Railways in Libya totaling 51 205 million (including 1 126 million euros (46 526 million rubles at the exchange rate on 30 June 2012) and 180 million Libyan Dinar (4 665 million rubles at the exchange rate on 30 June 2012)) (http://ir.rzd.ru). The amount of the commitments under these contracts amounted as at 30 June 2012 43 393 million (including 971 million euros (40 121 million rubles at the exchange rate on 30 June 2012) and 126 million Libyan Dinar (3 266 million rubles at the exchange rate on 30 June 2012)).

The company has entered into several long-term contracts for the construction and reconstruction of railway infrastructure in North Korea for a total of 4 567 million rubles. The amount of the commitments under these contracts amounted as at 30 June 2012 2 513 million rubles.

The consumer influence on the activities of the holding consists of the following:

- in case of special requirements to the quality of services and work performed; in the preferred use of a particular form of payment and ordering services and works;
- the ratio of the volume of freight and passenger turnover of the holding company and its competitors.

The consumer influence on the activity of the holding is particularly strong in times of crisis, when the number of paying customers is limited, and competition increased. In a General view of the company's customers can be divided into consumers of passenger and freight transport. Services for the delivery of goods provide the following subsidiaries of JSC "RZD":

- Federal freight company (JSC "FGC") offers a range of delivery services industrial goods: selection and supply of rolling stock, the organization handling, insurance, customs clearance, monitoring the movement of cargo at all stages of transportation. The main work is carried out with the coal, mining and metallurgical industries are: coke, iron ore, ferrous metals, machinery, ferrous scrap, non-ferrous metals, fertilizers, chemicals and soda, construction materials, industrial raw materials, granulated slags, refractories, cement, timber, manufactured goods. The highest percentage of freight traffic accounts for construction loads.
- The Issuer is a company that offers transportation of cargoes (including containers) marine and rail transport in all kinds of domestic and international traffic.
- Reiltransavto is engaged in the transportation of automobiles by rail, providing delivery "door-to-door, terminal handling with pre-sales service (PDI), custom documentation, on-line control of the location of a particular vehicle, full documentary support of car insurance.

- Russian Troika - the company carries out transportation of goods in twenty and forty foot containers, forwarding and shipping.
- Reefer service - organizes the transportation of perishable goods in their own isothermal rolling stock.
- Russian Railways logistics in addition to freight provides warehouse storage and terminal handling, customs and insurance services, organization of supply chains [9].

Market opportunities of JSC "RZD" represent the following factors:

- a worldwide trend towards the strengthening of the role of railway transport. For example, the President of JSC "Russian Railways" Vladimir I. Yakunin believes that Europe aims to make Railways practical alternative vehicles, including for environmental reasons. In the EU White paper on rail transport until 2030 to transfer to rail and water transport up to 30% of freight carried by trucks, and by 2050 more than 50%. The same trend affects and passenger transport. The growth of the potential demand for transportation service is feasible due to the development of high-speed highways that meet the following criteria: speed, reasonable prices, comfort, safety, regularity;
- participation "RZD" in the formation of the common economic space of Russia, Kazakhstan and Belarus by means of establishing a joint freight forwarder for container transport by rail;
- integration of Russia into the Western economic system, by means of accession to the WTO;
- the growth of the rail freight transport in the whole network by 2020 is projected at 40% on the Baikal-Amur mainline is expected to increase 2.5 times, on the approaches to the ports of Vanino-Sovgavanskogo transport hub - 3-4 times;
- support of the state Government The Russian railway industry;
- conclusion regulatory (network) contract, which regulates long-term relations between the state and the infrastructure owner of the holding;
- the dynamics of competition between the Holding company and other market participants;

  for many communities the branches of the "Russian Railways" are forming;
- cooperation with universities, technical schools, colleges, preparing staff for "RZD";
- simplification of procedures for the registration of innovations, inventions and utility models;
- strengthening the role of the media in re-branding and image-building process.

Market threats of the holding company, in our opinion, are:

- a decrease in the level of demand for transport;
- strengthening the role and effectiveness of the logistics business, the level of development of which Russia, Kazakhstan and Belarus are among the countries outsiders;
- lack of investment in rail infrastructure development, public investment today is 0.7% of GDP, the effective level will be 1.5%. World experience shows that significant investments in the transport infrastructure of other countries, in Germany the state invests in the infrastructure update for €2.5 billion, Austria - more than €2 billion a year in France and the UK with around €1 billion, in Switzerland - €0.7 billion;
- the increasing tendency of the state regulation of tariffs for transportation in the context of growing economic crisis, including cross-subsidization of industries;
- integration of Russia into the Western economic system, by means of accession to the WTO, and, consequently, large exposure to global crisis processes;
- negative impact of the global crisis on the real sector of the Russian economy

- increasing competition in transport and logistics business, including in the field of container transport;
- judicial proceedings in contentious cases with the participation of the holding company;
- ambiguous interpretation of Russian tax legislation;
- the decline in industrial production;
- improving the competitiveness of other transport modes, for example, in the Volga Federal district began a pilot project of inter-regional traffic on the restoration routes thanks which may directly get from one region to another by plane nonstop to Moscow. Earlier competition in these areas accounted for only bus transportation, now air cover 15 cities of the Volga district of Nizhny Novgorod and Kazan to Ufa and Perm. On this program from the Federal budget were 300 million, and regional, so ticket prices become available. The program will be extended to other Russian cities. According to research from the Ministry of Finance, the passenger traffic at distances greater than 1.5 thousand km showed steady growth in air transportation. However, long-distance rail transport is more competitive at distances less than 1.5 thousand km due to the price factor, because of the subsidies of the state. The advantage of the train is at distances up to 700 km;
- the tightening of expenditures of the state budget;
- the rise in the cost of borrowed financial resources;
- change the standard of living, the increased ambitions of young employees, high requirements on the employer.

Adding to the traditional instrument of PESTEL-analysis of two new factors - legal and environmental changes the value of all macro-and establishes a new equilibrium of the basic forces influencing factors on the activity of individual companies. Traditionally it was believed that the company's goal is to reduce the negative influence of the environment on the operations at the expense of internal resources. The concept of environmental management involves the relationship of all components of the environment with the aim of reducing the negative impact on the environment. For example, for JSC "RZD" it means:

- allocation of special bodies for environmental management at all hierarchical levels;
- use specialized automated programs;
- training staff in the field;
- environmental monitoring;
- a commitment to compliance with environmental standards, technical re-equipment, modernization of facilities, transition to ecological fuels.

3 Environmentally safe and sound technologies and their use in transport and logistics

The world is facing serious environmental problems such as climate change, resource depletion, air pollution and loss of biodiversity. All of these problems can have disastrous consequences for life on Earth, so it is necessary to develop innovative solutions and more environmentally friendly technologies, which could prevent the occurrence of such problems or at least reduce them.

Entrepreneurship and innovation can work together to create sustainable solutions that make better use of valuable resources and reduce the adverse effects of our economy on the environment.

Environmental technologies can help to reduce the consumption of energy and resources and create less waste and greenhouse gas emissions. Thus, fewer emissions occur at the expense of energy saved during the production or use of more environmentally friendly cars, contributing to the fight against climate change.

What are environmental technologies

Environmental technologies are technologies that – compared with others – are less harmful to the environment. They include technology and processes to manage pollution products that require fewer resources and services and procedures enabling the efficient management of resources.

Environmental technologies can be found in almost all economic activities, which includes pollution control, water management, waste management and energy production. In addition, these technologies generate fewer emissions, less waste and their impact on health and biodiversity is limited and generally contribute to cutting costs and improving competitiveness.

What are eco-innovations?

Environmental innovations are all kinds of innovation (technological and non-technological, new products and services, and new business practices) that create business opportunities and by preventing or reducing their impact or improving the use of resources (this also applies to energy use) benefit the environment. Environmental innovations are closely linked to the development and use of environmental technologies, as well as with the concepts of environmental performance and environmental industries. The overall objective is to contribute to more sustainable patterns of production and consumption.

Practical examples of environmental innovations include procedures for obtaining useful materials from waste water, efficient food packaging, production of building materials from recycled waste, environmental products and new management methods.

The importance of developing new technologies in transport and logistics

The start of the third technical-technological revolution in transport can be put in the sixties of the last century. Developing economies with developed social (and spatial) division of labour made entirely new requirements for transport system. The mentality of operators (users), especially on the basis of a new concept of business logistics also changed (Ogorelc, 2004).

In today's rapidly evolving global world, those who possess cutting-edge technology from their competitors are more productive and are able to better process technology to produce the same products cheaper, or those who are better organized and therefore can more quickly react to market signals, as well as those who quickly respond to customer requests (Jaklič & Svetličič, 2005).

Many technological changes have marked the end of the 20th century, and of course the transition into the new millennium. The most prominent ones were in the information and communication field. Technological changes typically do not affect only some of the activities, industries or companies, but penetrate all areas of the economy. It is a series of related technologies that create certain technical economic subsystems.

Technological advances have significantly reduced the cost of transport and communications, which produced economic globalization within a certain period of time and space. This is the so-called effect of temporal and spatial compression of technological progress, which has largely reduced the cost of international trade and investment, enabling the organization and coordination of global production (for example, Ford Lyman was designed in Germany; the transmission is produced in Korea, the pump in the U.S. and engine in Australia). (Shangquan, 2000, p. 2).

Issues related to improving energy efficiency, reducing pollution, the use of biodegradable and recycled materials, reducing vehicle weight by using new materials and technologies as well as providing better driving performance and enhanced security are fundamental challenges that determine the direction of development of transport or means of transport logistics. Ecological aspect is so crucial for the further development of this area.

Eco-costs are often external and represent a wide range of burdens and costs, which providers 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 to environmental and cost considerations in the cost of operations.

Increased competitiveness and environmental protection

To provide valuable support for successful decision-making, managers need a balanced set of measures that represent different requirements, but certainly they should follow modern concepts of warfare in a competitive environment.

Clean and healthy environment is essential if we are to maintain prosperity and a high quality of life in Europe. In order to maintain this quality of life there are very important the strength and competitiveness of the economy.

Development and implementation of new solutions are essential to creating opportunities for economic benefits by enabling cost reduction, innovation and international trade.

Environmental technologies can open up potential markets, foster innovation, increase European competitiveness and create high-skilled jobs. The European Union has recently launched Lead Market Initiative, which identified a number of market areas, which are areas of future high growth in Europe. Most of the activities that have been identified as leading markets, like activity as sustainable construction, recycling; bio-based products and renewable energies, etc. are the main markets for environmental innovations.

Environmental innovations will not only benefit the environment. The global market for environmental products and services is increasing every year.

Europe is on track to become a leader in the field of exploitation of the power of innovation to solve today's environmental challenges, in addition, has a great opportunity to strengthen investment in this relatively new sector.

In recent years, the environmental industry is becoming an important part of the European economy. The revenue these activities amount to approximately € 227 billion, equivalent to 2.2% of EU GDP - which is more than in the European aerospace and pharmaceutical industries - and directly employs 3.4 million people.

Market for environmental technologies is growing in line with increasing their potential. Some activities are rapidly expanding in Europe and in the world - more than 20 % per year growth in some renewable energy sources such as wind energy. Europe has about one-third of the global market for environmental technologies, which are projected by 2020 from the present level increased to EUR 1 000 billion.

In general, however, the Europe is a leader in the development of new technologies, but the product or service is not always easy to download from the level of research in the market level. There are many barriers to the development and wider use of environmental technologies.

Market demand for environmental technologies in the public and private sectors is low for various reasons. These include chained to the existing technology and prices that favour less eco-efficient solutions, difficult access to financing and low consumer awareness.

The transition from traditional to environmental technologies is a complex process. Here you can encounter economic barriers, such as higher investment costs due to the alleged risks and significant

start-up costs. The transition from design to production is also hampered by the lack of venture capital in this area.

Systems that support innovative companies are inadequate, should be encouraged private investment in research across Europe. Applied research, in particular the cooperation between Academia and the industries need more support.

4 Transport modelling

Logistic and supply chains have an important impact on inner-town transport and urban organization. Transport modelling help to visualise traffic flows and load-bearing capacity. Logistic solutions of today should be environmentally friendly on the one hand, and fulfil the exigent transport requirements in urbanized zones, on the other hand. Transport modelling use measured data to visualize the current situation or the prognosis. Work with the modelling programme is very operative - data can be varied during the modelling process. Transport modelling has to be complex, because each of the element influents total transport flow in the town.

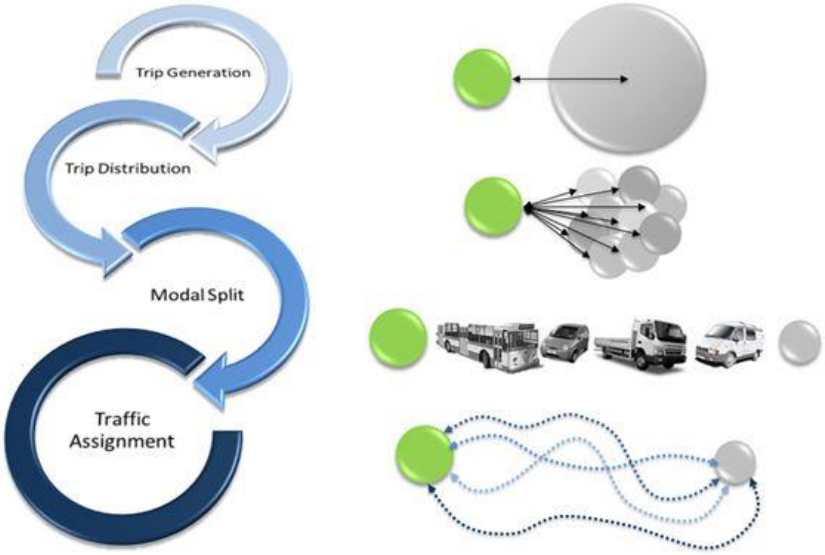
It has to be taking into the consideration:

- who/what will be transported
- the star and the end point of the trip
- the time of starting and finishing the trip
- trip purpose
- means of transport

The main purpose of transport modelling is to understand transport flows during the variation of boundary conditions. Modelling can visualise transport flows of people, goods or even the information. Transport modelling has four phases:

- analysis of transport needs (transport volumes of source and target transport area),
- distribution of transport flows (transport flows directions),
- distribution of transport flows by means of transport (distribution of transport service),
- distribution of transport loads on routes and road segments.

Figure 16: Process of transport modelling creation



The advantage of transport modelling is, we can modify the input data concerning transport intensity and structure of traffic flow. It is possible, as well, to vary input data of the ratio of cargo transport, its distribution and to monitor transport situation during the changes input data. Load-bearing capacity of transport infrastructure is a result of logical modelling - assigning of roads to volumes of vehicles.

The transport is a phenomenon that significantly affects the life of the population. Ensure its functionality while protecting the environment and social environment in residential areas is a task that should be a priority for traffic planning activities.

Infrastructure planning and environmental protection – case study of Slovakia

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1 Urban Air pollution

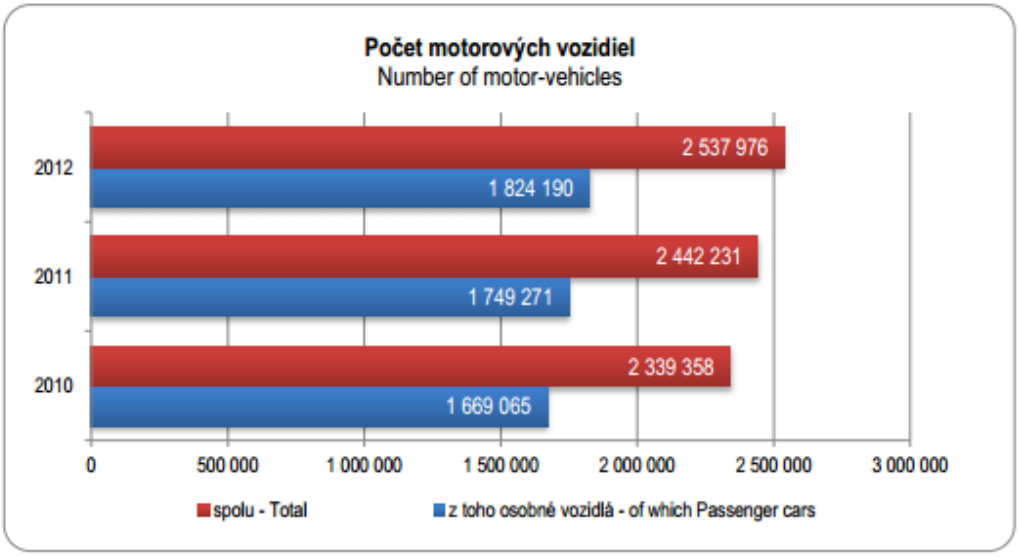
The fleet

The number of motor vehicles has considerably increased since 2000 (see figure 1). In 2010, the number of passenger cars exceeded 1,669 million.

The increase passenger car numbers were markedly higher in the Slovak Republic than the EU average. Between 1990 and 2005 (the period with comparable data), the original EU15 experienced an average increase of 24%, the EU25 of 31% while in the Slovak Republic alone the increase amounted to 7.8% between 2010 and 2012. These data reflect the dynamic growth in motorisation in the Slovak Republic after 1989, in contrast to Western Europe, where the market was a lot more saturated in 1990.

The average age of registered vehicles is among the oldest in the EU (17,2 years total, 13,9 for passenger cars in 2007).

Figure 17: Number of motor-vehicles in Slovakia



Source: ŠÚSR, 2014

The transportation network

Historically, the Slovak Republic has been among the world` s leading countries with respect to the density of transportation networks. In 2013, there 0,53 km of roads (0,99 km in the EU15) and 0,014 km of highways (0,016 km in the EU15). The length of routes stagnated between 1989 and 2006 (see Table 1). While the total length of roads decreased by 1% during this period, the length of motorways and high-speed roads increased considerably. The use of the road network, while its length stagnates, is massively increasing. In the areas with the heaviest traffic, transportation intensity reaches tens of thousands of vehicles per day. The most frequented is the D1 motorway and 1 st class road I/18 where, near Žilina`s city limits, the average intensity is close to 60 000 vehicles per day. The capacity of the most frequented routes is becoming insufficient, resulting in frequent traffic congestion and a higher risk of road traffic accidents.

Table 3: Infrastructure of road in Slovak Republic

year	Roads and motorways					Total	Local communications
	Motor-ways	Express-ways	Roads 1st class	Roads 2nd class	Roads 3nd class		
	km						
1999	295,0	*	3220,1	3826,2	10392,6	17733,9	24978,7
2000	295,7	*	3221,7	3826,3	10393,7	17737,4	25219,9
2001	298,7	*	3220,4	3827,9	10391,4	17738,4	25219,9
2002	306,5	*	3224,3	3828,7	10395,5	17754,9	25219,9
2003	318,2	*	3334,7	3728,7	10396,0	17777,6	25219,9
2004	322,4	78,0	3263,3	3729,0	10393,9	17786,5	25219,9
2005	333,7	79,7	3341,1	3733,5	10400,6	17809,0	25219,9
2006	333,7	104,7	3359,0	3742,1	10398,8	17833,6	25942,0
2007	372,5	*	3365,9	3742,4	10403,4	17884,2	25942,0
2008	392,8	159,0	3275,0	3686,3	10402,0	17915,1	25942,0
2009	399,9	180,0	3317,0	3644,0	10406,0	17946,9	25942,0
2010	427,0	190,0	3318,0	3643,0	10408,0	17986,0	25942,0

Source: ŠÚSR, 2014

Figure 18: Infrastructure of road Slovak Republic – percentage in year 2010

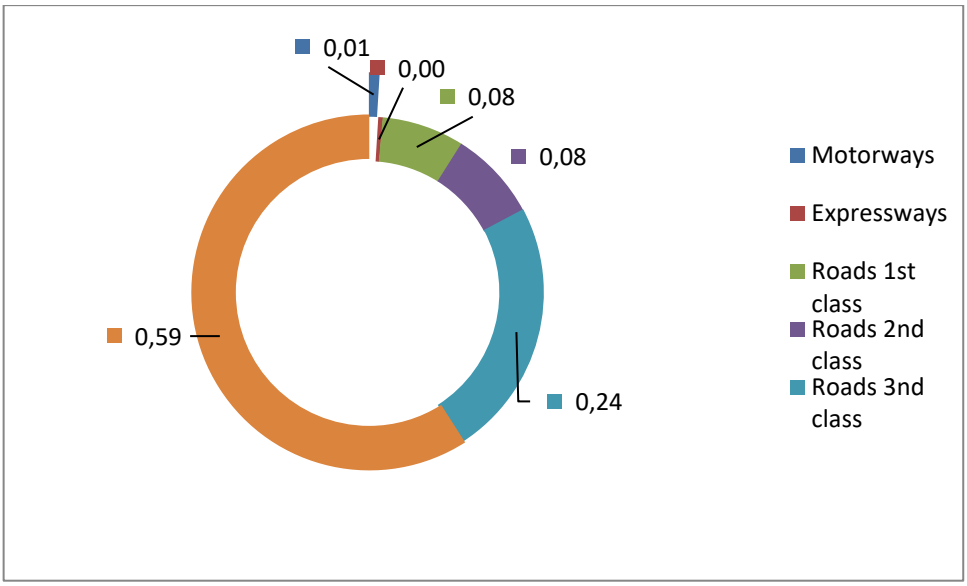
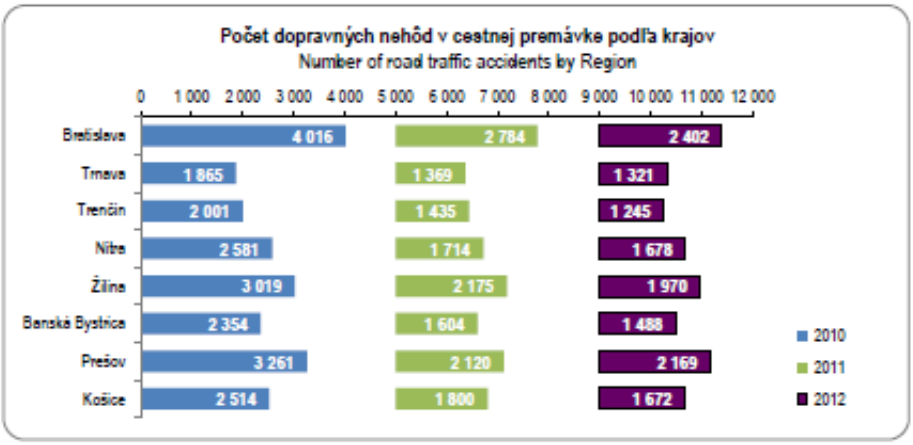


Figure 19: Number of road traffic accidents by Region



Transportation emissions

Emissions from motorised transportation modes (hereinafter `transportation`) represent a major burden on the environment and also a pressing problem of today. The share of transportation in total air pollution is on the increase even in spite of clearly decreasing specific emissions (per unit of transportation performance of the individual transportation modes), especially for private automobile transportation.

Secondary dust pollution means particulate matter settled on routes that are stirred up by passing vehicles and returns to the atmosphere. This can include transportation emissions, tyre and brake wear, and pollution from other sources, e.g. from heating, construction activity etc. The danger of dust pollution (both primary and secondary) lies mainly in the fact that dust particles attract other toxic substances, e.g. carcinogenic benzo [a] pyrene, for which it is easier to enter the human respiratory tract on such particles, jeopardizing human health.

As shown in Figure below, the share of transportation in the total air pollution in the Slovak Republic increased for substances PM and NOx. A significant aspect for pollution-related health risk is that transportation pollutes the surface layer of the atmosphere, especially in densely populated areas,

which contrasts, for example, with the energy industry, which is characterised by long-distance pollution transmission affecting more remote areas that are often less densely populated.

Figure 20: Trends of transport emissions of air pollutants in Slovakia (thous. tonnes)

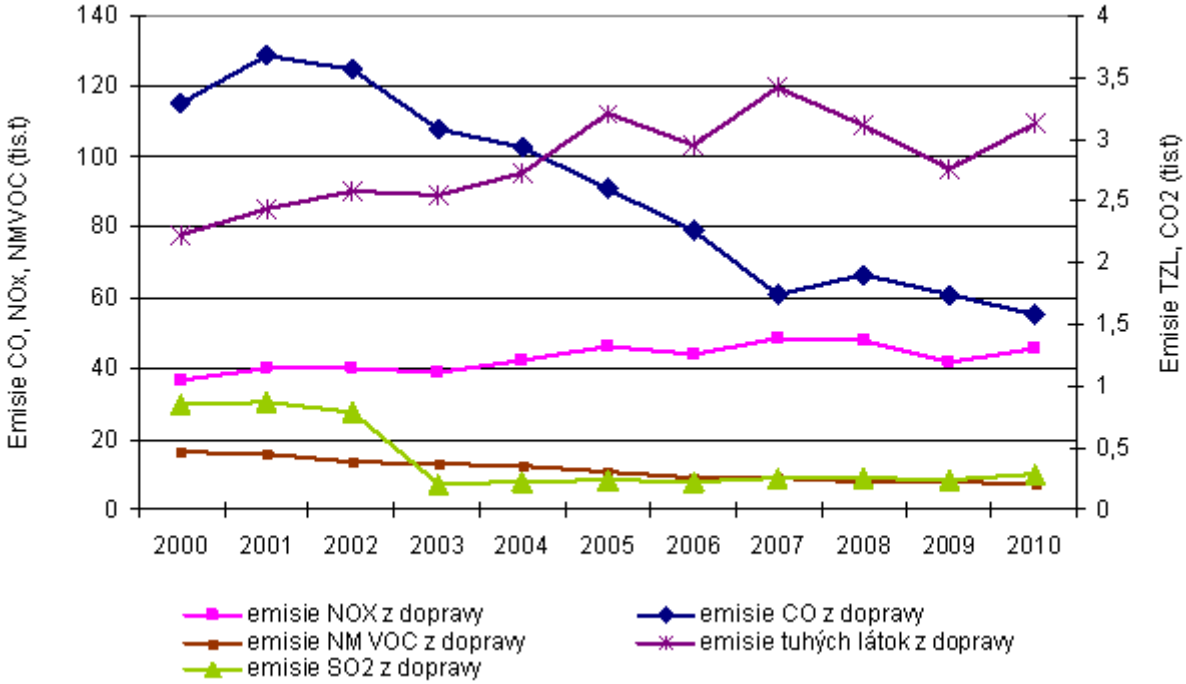
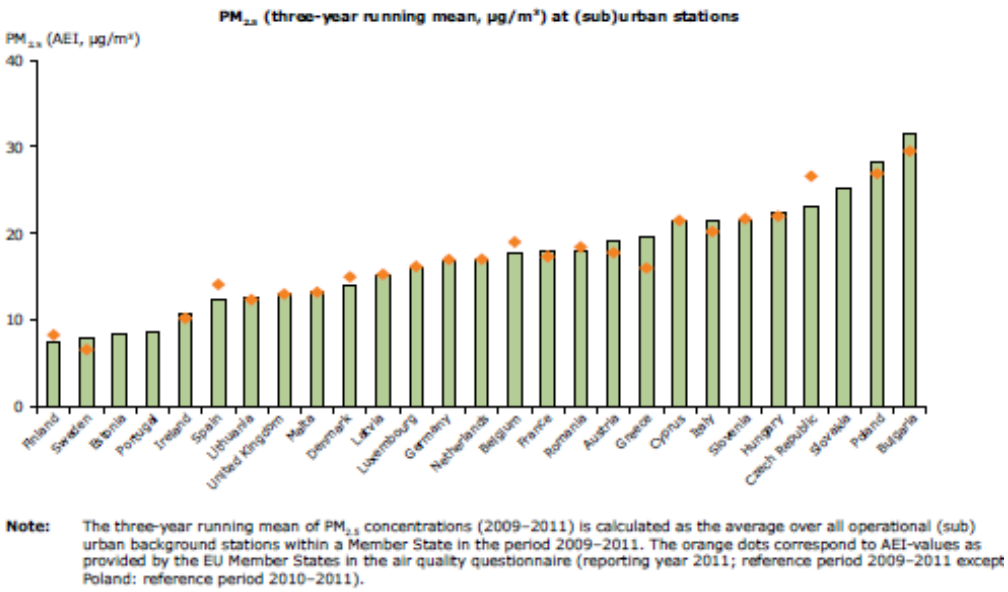


Figure 21: Urban PM2.5 concentrations presented as multi-annual average in EU, 2009–2011



Source: EAA, 2013

The effects of transportation on the atmosphere

Emissions from transportation, especially in highly-trafficked localities, considerably reduce air quality. Transportation tends to be connected mainly with nitrogen oxide pollution (the highest concentrations have consistently been detected in Prague, in Legerova street, where there is no other significant

pollution source) and the photochemical smog. This means air pollution by toxic products of photochemical processes in the atmosphere (especially low level ozone) from the precursors that are largely generated by transportation (nitrogen oxide, VOC and others). These processes mainly take place in summer, at higher temperatures and when there is more intensive solar radiation, which is why photochemical smog is also sometimes referred to as summer smog.

Table 4: Annual averages of ground level ozone concentration [µg.m^{-3}],

Station	2005	2006	2007	2008	2009	2010
Babská Bystrica, Zelená					**53	56
Bratislava,Jeséniova	68	66	59	59	60	61
Bratislava, Mamateyova	53	50	49	48	48	46
Humenné, Nám. Slobody	60	62	56	55	59	53
Jelšava, jesenského	52	55	56	51	49	44
Košice, Ďumbierska	67	*49	57	56	81	63
Nitra, Janíkovce					**74	53
Prievidza, Malonecpalská			48	53	50	49
Žilina, Obežná	41	44	44	46	48	47
Gánovce, meteo stanica	67	68	60	65	62	63
Chopok, EMEP	95	*96	91	92	90	87
Kojšovská hoľa	86	84	79	76	85	90
Stará Lesná, SAV, EMEP	70	73	68	74	61	67
Starina, vod.nádrž, EMEP	66	*62	62	59	58	51
Topoľčany, Aszód, EMEP	60	60	58	60	59	55

** 50 – 75% of valid measurements, ** ozone measurement introduced in 2009*

Source: SHMU, 2010

In 2010, the annual average concentrations of ground level ozone in urban and industrial locations of Slovakia ranged within the interval 46 – 63 µg.m–3 (Tab. 2). The concentrations in the rest of the territory ranged between 51 and 90 µg.m–3, mainly depending on the altitude.

2 Impact of road transport on air pollution

Traffic participates very strongly to the polluting of ground layer of the atmosphere, where the life matures, especially an emission - the concentration of emitted polluting substances. It is caused by emission of the main polluting substances from traffic (CO – carbon monoxide, NOx – nitrogen oxides and VOC – volatile organic compounds) near the earth ground.

The problem of air polluting from the traffic is impossible to solve by increasing the height of air polluting substances release, what is the solution of industrial sources, where achieving the allowed emission limits is reached by determination of the minimal height of the chimney. The way of reducing effects of the traffic to polluting the ground layer of the atmosphere is in reduction of emissions from the vehicles with the technical development of combustion, with intercepting, eventually transforming

polluting substances with the catalysts. Another solution may be deflection or redirection of the traffic in the most polluted area.

Effects of the traffic to air pollution

Loading the environment by human activity – the traffic – rises with the bringing the chemical, physical and biological components into environment. Important is don't exceed sustainability of the territory and do not damage it. The traffic loads environment during the construction and operation, most with the noise and emissions. Nowadays there are such a technological methods and technical equipment of the roads, which can protect overrun of the specified hygienic limits.

Traffic and traffic industry in Europe consumes 20% of the overall energy, from this amount 83% consumes road traffic, which also produces 81% CO and 51% NOx. Motorways can decrease this average in about 25%. In Slovakia, the traffic shares about 23% of the air polluting, the main contaminator is power engineering with 42%.

Pollutions from cars exhaust and raising dust, caused by whirling the sedimentary particles on the surface of the pavement and its vicinity, contributes at most in air pollution near the roads.

3 Possibility of minimalization traffic effects to environment

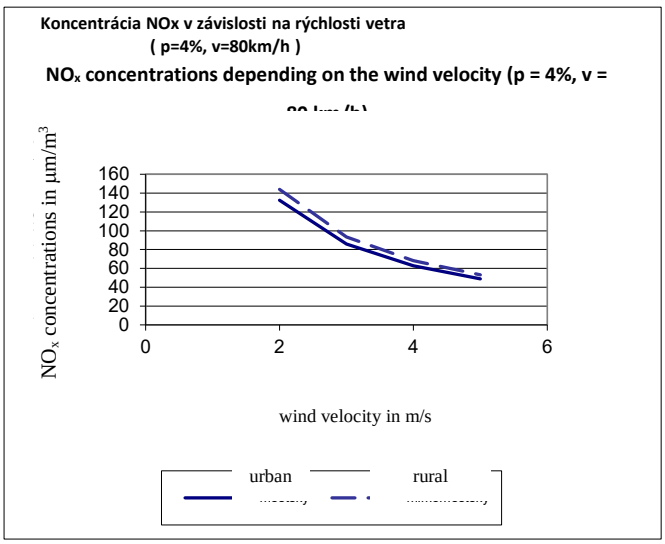
Next traffic progress is in separately conjunct with the demand of significance the life style, the way of living and economy. The framework defined through politics, where the traffic concepts can be set, depends on the changing the attitude of society to these demands. Traffic policy must therefore consider global and regional conditions. Such a strategy has got a perspective, which consider with the change of the traffic systems and with the limitation of ineffective traffic. Harmful effects of the traffic to environment must be restricted with the enforcing faster, safer and more comfortable public traffic service, as well as limiting the individual traffic, especially in large cities.

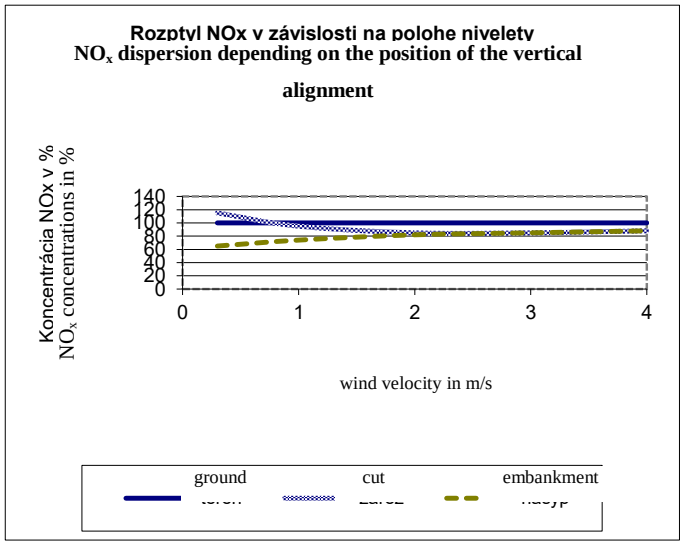
The influence of the layout to the emissions dispersion

The quality and cleanness of the atmosphere has become a serious problem in traffic networks planning in and outside the cities, in traffic organization and regional planning. Traffic collapses in the cities, means increase in concentration of pollutions.

Nitride oxides are one of the most significant parts of exhaust, because they reach the highest concentration of pollutants produced to the atmosphere. They are also easy to monitor and can be estimated. That's why they are used as an indicator of air pollution with the exhaust from the traffic.

Figure 22: The influence of the wind velocity to the emission dispersion and the influence of the construction limits position





The position of the road is permanent after the construction, so it is necessary to pay attention in design of the communication systems. By (Mlus-92) the dispersion of pollutants in dependence of the vertical alignment position (in the cut, on the ground, on the embankment) was monitored and the results show, that this dependence on the position manifests in the wind velocity lower than 3 m/s, when the formation level seems to be more suitable for emission dispersion. Concentrations of NOx monitored near the road on the embankment were 2 times lower than near the road placed on the ground.

In the Figures 1 and 2 are presented comparative entries calculated for the road section with the same directional orientation and the length of 1km, the category MS 21.5 for urban driving mode, which responds to local distributor road and R22.5 for rural (fluent) driving mode. Considered number of passenger cars was 10’000 / 24 hours, trucks 1’000 / 24 hours, peak traffic in half of an hour was considered as 5% from 24 hours’ traffic.

Road greenery

Effective usage of the road greenery can considerably reduce negative impact of the automobile traffic. In the past the effect of the greenery was not enough used. Nowadays, the protection and creation of the environment and its enhancement comes into dependence with the problem of balance between civilization and biological element of a human. One of various functions of the greenery is filtration, so the greenery plant is applied along the roads.

But not every form of planting betters the situation. Very important is the depth of the planting and its filtering efficiency. The greenery can capture the dust and equally disperse the emissions.

Regulation of the wind velocity with the dense planting, increase the dust in the vicinity of the road. More effective are species, which allow the wind to blow through.

Figure 23: Dense greenery

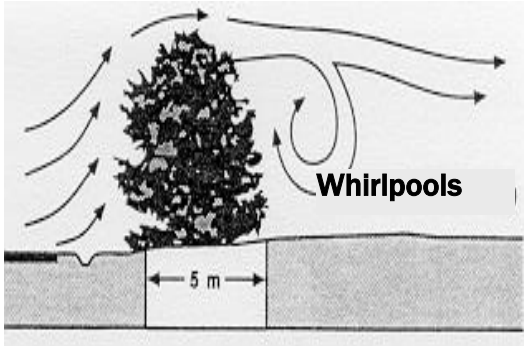
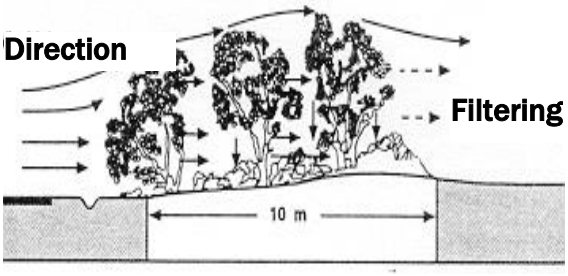


Figure 24: Foliage greenery



Bushed foliage dense greenery, with the width of 5 m reduces the dispersion of the pollutants to the environs in 20%. The greenery with the width of 10m reduces the dispersion of the pollutants in 60% in the summer. The most proper is the combination of the foliage and coniferous species. There is no oscillation in the efficiency of the planting between summer and winter.

Arrestment of the particulates with the oxygen production and consumption of the carbon dioxide is wear by the foliage and coniferous species. By gas pollutants the greenery is effective only in low concentrations. Failing which the coniferous species are drying up. From presented comparisons is resulting, that it is necessary to solve the question of the traffic impact to air pollution in the urban agglomerations in land planning documentation, where the location of the roads is determined.

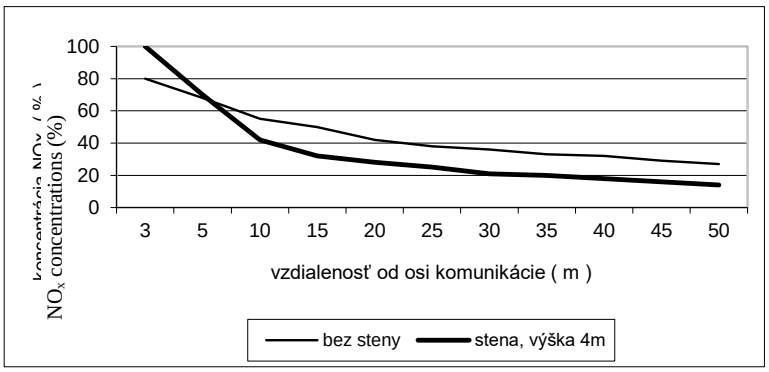
The need of balance, between civilization and biological element of the human, manifests especially in urban agglomerations, where the automobile traffic makes the environment worse.

Also the noise from the traffic is significant in urban agglomerations. The greenery mutes this noise depending on the width of the green belt. More expressive muting manifests from the width of 15 – 20 m. In the green belt there is appropriate combination of the trees and brushes, in order to effective protection from the noise. It is necessary to combine foliage and coniferous species, because the foliage species has got no effect to noise protection in vegetal standstill. The reduction of noise energy, consist in large amount of reflections on the leaves, branches and needles, so not in absorption.

Noise barriers

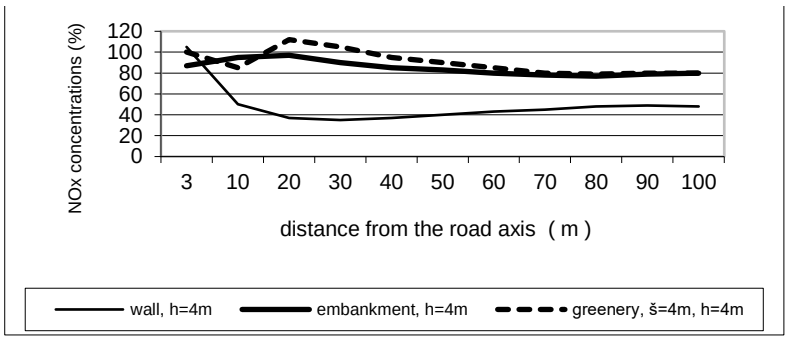
Construction of the noise barriers has got positive influence also to the emission dispersion. Otherwise, the wall makes a barrier that affect the concentration of the gas elements near the road, but if it is properly situated, it can reduce this concentration behind the wall. Therefore, it is suitable to construct the footpaths behind the noise barriers.

Figure 26: Effect of the noise barrier to the emission reduction (wind velocity > 2m.s^{-1})



Source: Pischinger, 1991

Figure 27: Comparison of greenery, noise wall and embankment



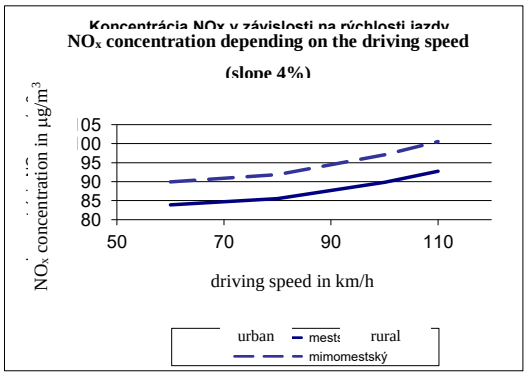
From the presented comparisons result, that it is necessary to solve the impact of the traffic to air pollution on the level of land planning documentation, where is determined the location of the roads.

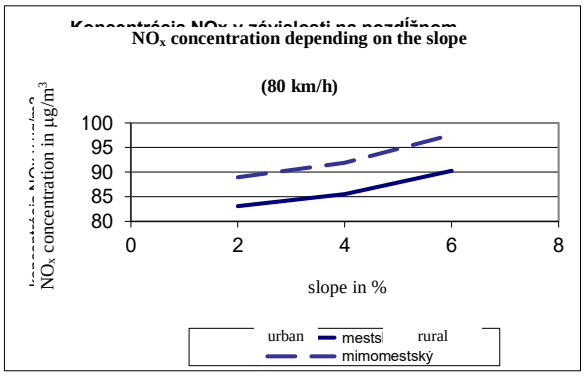
4 Possibility of the emission production affection

Reducing the source of the pollutants means the change of the traffic flow intensity, reducing the

Figure 28: Effect of the driving speed and slope

freight traffic, limiting the speed, what can be done with the roads signs and synchronization of the traffic mode in the communication system (green waves).





In the figures above are presented comparative entries calculated for the road section with the same directional orientation and the length of 1km, the category MS 21.5 for urban driving mode, which responds to local distributor road and R22.5 for rural (fluent) driving mode. Considered number of passenger cars was 10'000 / 24 hours, trucks 1'000 / 24 hours, peak traffic in half of an hour was considered as 5% from 24 hours' traffic. The calculation follows the SAV (Slovak Science Academy) methodology.

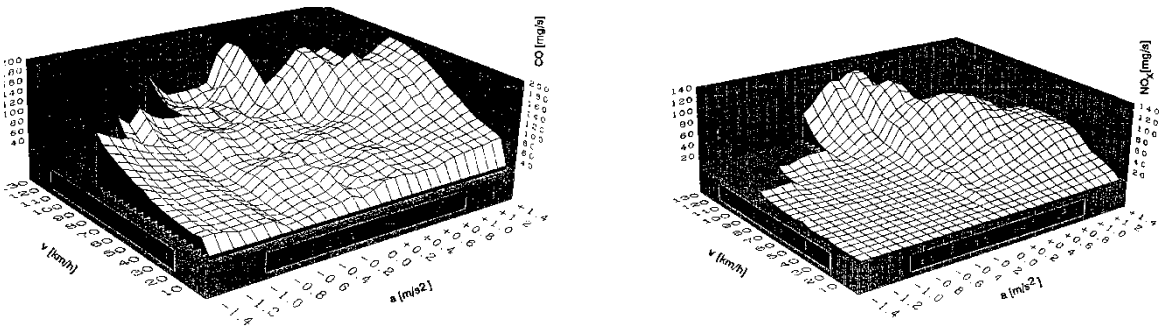
Effect of the traffic regulation to the emission production

In the enhancement of the environment in the urban agglomerations, a significant role acts preventive approach to solving the problems. Nowadays, traffic is a problem of every city. One of the example how to solve this problem, in term of air pollution from the traffic is a large study of Technical University of Graz (Pischinger, 1991).

Research workers from TU Graz elaborated a study, based on testing the traffic in selected part of the town, where they evaluated fuel consumption and emissions from the traffic in uncontrolled zone, with the speed limited at 30 km/h and 50 km/h in the same zone.

Emissions of nitrogen oxides NOx, carbon monoxide CO, hydrocarbons HC, fuel consumption and travelling speed were monitored. These factors were calculated to passenger car unit (PCU), which is based on the traffic flow composition, where 67% are vehicles, with gasoline engines (Otto's engine) without catalyst, 21% gasoline engines with catalyst and 12% diesels.

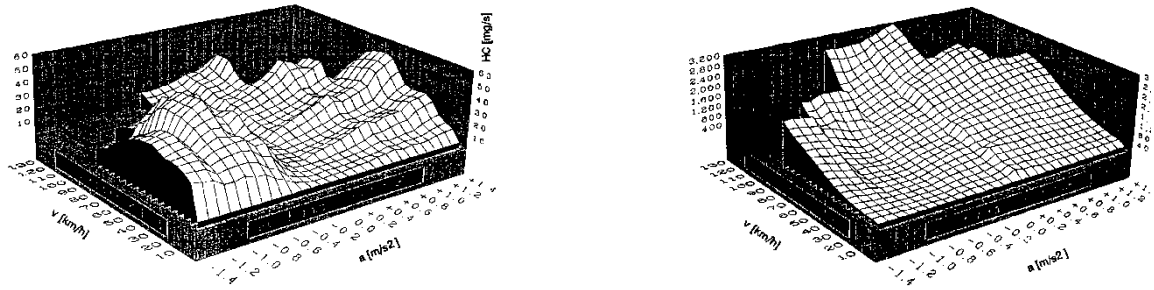
Figure 29: CO and NO_x production for PCU



Because the engine activity relates to the road profile, there was evaluated the productions of the emissions of the passenger car unit before, in front of and between (where we can expect constant speed) the junctions (see figures above).

Production of the CO strongly depends on the traveling speed, as well as production of the hydrocarbons, but in the production of the nitrogen oxides, the traveling speed is not significant.

Figure 30: HC production and fuel consumption for PCU



5 Mathematical modelling of the air pollution

In the first approximation a street may be taken as a line source of pollutants, where produced pollutants are distributed equally. There are several different methods of mathematical modelling of air pollution from the traffic.

Analytical model – linear source

The easiest model of the air pollution from the traffic is based on an elementary half empirical Gauss relationship for pollutants distribution in a smoke tow from linear source. For the ground concentration of a pollutant stands:

$$C(x,y,0) = \frac{2q}{\sqrt{2\pi} U \sin\varphi \sigma_z} \cdot E(y_1, y_2) \qquad (1)$$

where q is emission from the linear source (mg.m^{-1}.s^{-1}), U is wind velocity (m.s^{-1}), φ is angle between the wind direction and the road axis, σ_z is empirical parameter characterized vertical dispersion of the pollutants. Function $E(y_1,y_2)$ expresses effect of the linear source finality to the distribution of the pollutants near the ends of the road.

$$E(y_1, y_2) = \int_{p_1}^{p_2} \frac{1}{\sqrt{2\pi}} exp\left(-\frac{p^2}{2}\right) dp = erf(p_2) - erf(p_1) \qquad (2)$$

where $p_1 = y_1 / \sigma_y$, $p_2 = y_2 / \sigma_y$, σ_y is parameter characterized horizontal dispersion of the pollutants.

For unlimited source, where $y_1 = -\infty$, $y_2 = \infty$, function $E(y_1,y_2)$ will be $E(y_1,y_2) = 1$.

Presented model is simple and reliable and is used to compute the air pollution from the traffic over large areas. Detailed description of this model is in Ďurčanská & Hesek, 2000.

Description of the program for modeling the emission production

Mathematical modelling performs after traffic prediction. Horizontal alignment of the road must be placed to coordinate system. Studied area around the road or object is fit into grid of the size 10 or 100 meters between the points, according to the largeness of the area where the emission production and nitrogen oxides concentration is enumerated.

Assumptions and mistiness of the computing model:

- estimated average speed of the traffic flow,
- specific emissions are considered for general composition of the traffic flow, for actual traffic volume and perspective in next years,
- windy conditions about dominant wind direction based on average data from long-term monitoring of SHMU (Slovak Hydro-Meteorology Institution), average wind velocity is determined from all measurements, include doldrums,
- the most unfavourable air stability is considered, when the breathing zone is most charged.
- Modeling input data
- In numerical model for modeling the emissions from mobile sources are considered:
- emissions factors for actual and future fleet,
- traffic volume and its composition according to vehicle type,
- longitudinal slope of the road,
- urban or rural traffic mode (driving fluency, buildings along the road),
- period of emission production evaluation,
- driving speed,
- meteorological conditions (direction and velocity of the wind),
- climatic conditions (according to Pasquill-Gifford categories of stability).

6 Model utilization

As an example we present modelling of the air pollution from the traffic in Šaľa.

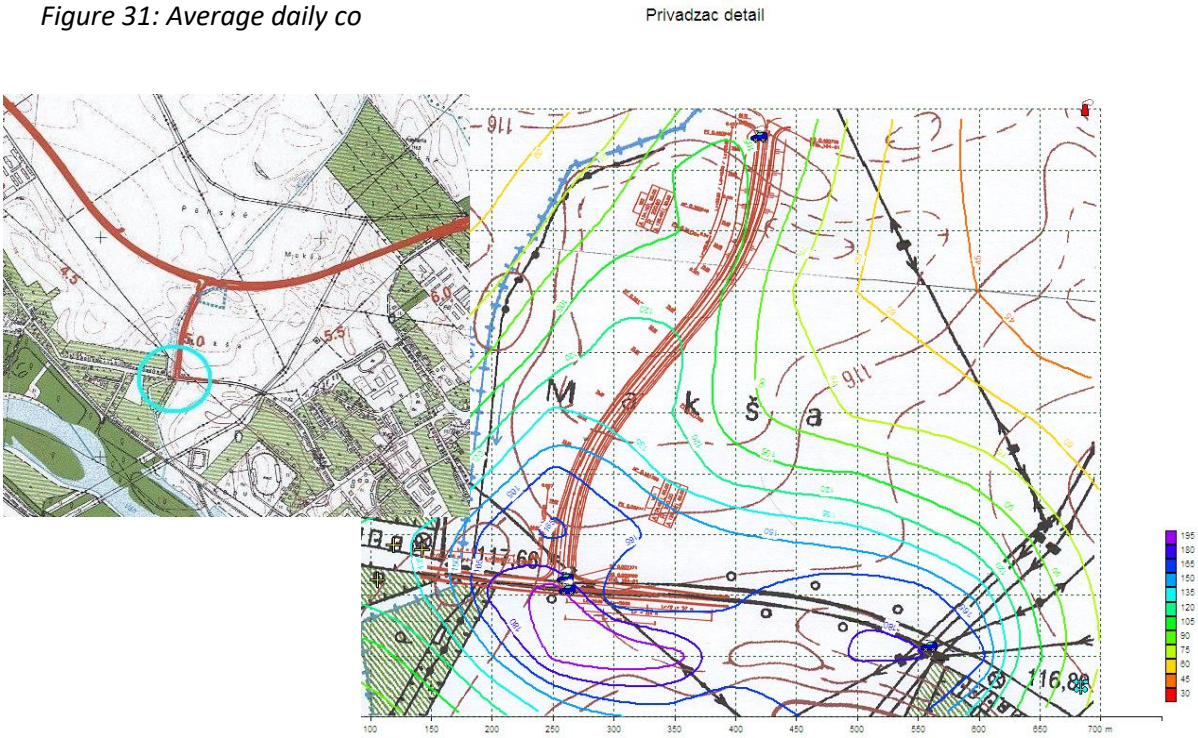
Performing of the mathematical modelling is based on traffic forecast for monitored area. Forecast of present state is based on state-wide traffic count. Next data about traffic volume are taken over traffic-engineering details, which were prepared for project of the bypass around Šaľa. Traffic volume for 2015 is calculated by forecast coefficients from state-wide traffic census.

The communication system of the city was fitted to a grid of point with spacing of 100 m, where concentrations of nitrogen oxides were modelling.

Expected effects of the traffic in the city

In modeling the air pollution was appreciated overall number of production of pollutants in the atmosphere (t/year) from 24-hour traffic, also were compared concentrations of nitrogen oxides NO_x ($\mu g.m^{-3}$) on the sections with the highest traffic volumes, originated from average daily traffic and were compared with permissible limits concentration of NO_2 (Ďurčanská & Moravčík, 2003).

Figure 31: Average daily co



The impact of static traffic to air pollution in urban agglomerations

Till recent time the impact of parking places wasn't appreciated for the quality of atmosphere. Relative to the construction of hypermarkets there have been built large parking places with the capacity over 300 standings. Legislatively, each parking place is evaluated as small source of air pollution, but huge parking places can markedly affect the quality of its environment. A parking place works as a ground source of pollutants. During unfavourable meteorological conditions – the temperature inversion and a weak wind motion – in surroundings of the parking place can be created the zone with excessive air pollution. Negative impact of parking places can be almost completely eliminated by collective garages. Polluted air can be exhausted and lead over the roof of the garage, where it is dispersed into the atmosphere in much better disperse conditions.

7 Static traffic by the shop centre

The survey of static traffic

The static traffic census can be realized for finding various matters: to discover the compound of parking vehicles, hour and elapsed time of parking. These parameters have the expressive influence on the parking places emissions.

Because we want to deal with parking by supermarkets, we know that there are parking just a personal vehicle during shopping in the supermarket. The values related to the time of parking and saturation of parking through the day is very interesting. That's why the surveys were carried out, where the notations on the entry and exit roads to the parking places were made.

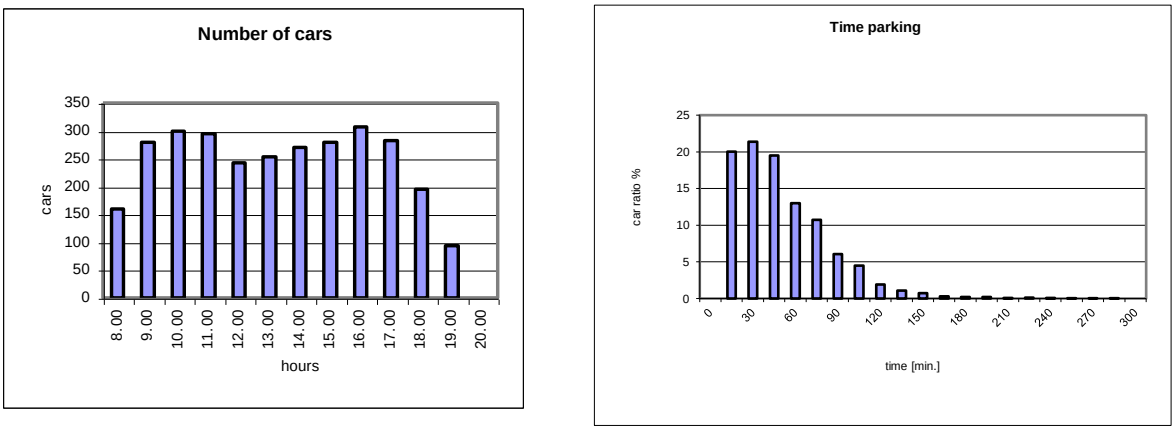
The saturation of daily static traffic

By the construction of a new pollutant source we need to know the current air pollution in this area. The active stationary heating sources with regard to their height of chimney have the minimal impact on the pollution of the surface air. The busy contiguous roads and huge adjacent parking places have the most negative influence on the air quality. By the evaluating of the contribution of the designed hypermarket on the air pollution therefore at first the parking place and the due to hypermarket increased traffic on the adjacent roads is taken into consideration. In addition, the influence of heating sources on the air pollution is calculated. For the evaluation of the negative impact of the parking places we need to know the parking mode or changing of the cars on the parking.

By the project of traffic prediction in the region where the shopping centre will be built we start from already curried out surveys. This is why we present the comparison of the results of parking monitoring by the standard shopping houses in the centre of the city and parking by a big shopping centre out of a city.

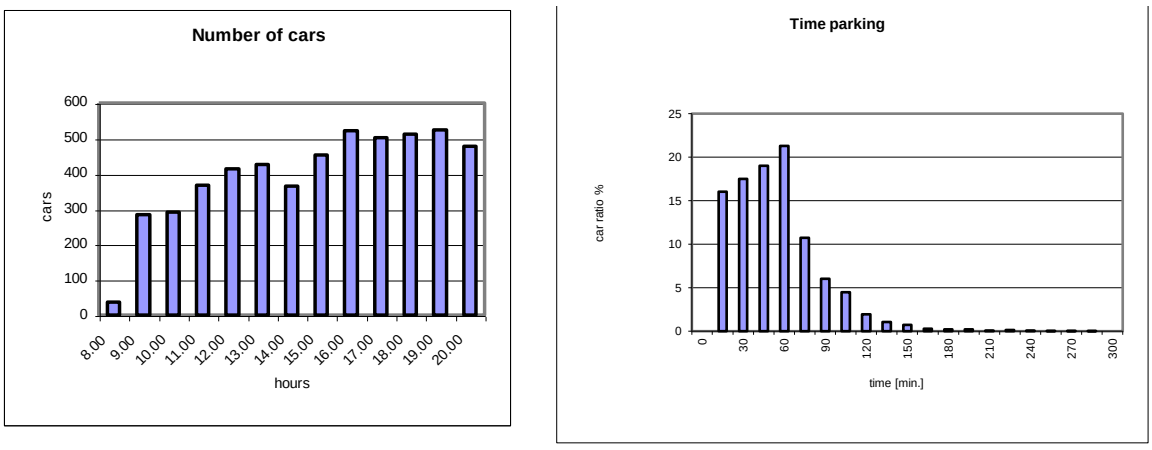
On the Figure 21 the occurrence and time of parking vehicles of the shopping house in the centre of a city is showed. On Figure 22 the situation on the hypermarket parking place is shown.

Figure 32: Number of cars and time parking in city



Source: Ďurčanská & Hesek, 2000

Figure 33: Number of cars and time parking in hypermarket



Source: Ďurčanská & Hesek, 2000

It can be seen from the graphs the saturation of the shoppers through day differs in the shops from the hypermarkets. The distribution of the parking in the shop during the day is almost constant from 10.00 till 18.00 o'clock, in the hypermarket it is concentrated after the working hours, e.g. after 15.00 o'clock, with the about double number of the parking cars, comparing with the morning hours. Different is also the time of parking, whereas the hypermarkets have got a larger area and greater offer of services, so the parking time is in longer. As it is seen from the histogram, the parking time in the hypermarkets creates almost the ideal Gaussian curve with the mean parking time round 1 hour. If we assume, that the time, during that the car is on the parking place with the started engine (standing + moving) is about 3 minutes, by the mean parking time 1 hour 5 % from all cars have started engines.

Emission of parking place

On the assumption that the car arriving to the parking place moves slowly, leaving it starts with the cold engine the emission of one car will be:

$$CO - 55.0\ mg.s^{-1},\ NO_x - 2.1\ mg.s^{-1},\ VOC - 7.7\ mg.s^{-1}.$$

If we assume, that 5 % of all N cars have started engines, then emission of parking place will be

$$CO - 2.75\ N\ mg.s^{-1},\ NO_x – 0.105\ N\ mg.s^{-1},\ VOC – 0.385\ N\ mg.s^{-1}.$$

In these days by the hypermarkets the parking places with the capacity of 300 till 1000 vehicles are built. Such parking places produce every second 1.825 till 2.75 g CO, 0.0315 till 0.105 g NO_x and 0.1155 till 0.385 g VOC. Overlapping of the parking place with the efficient air-ventilation could the one of solutions of this problem. Such solution is expensive and therefore not realistic. By this time this problem is solved by the constructing of hypermarkets out of living zone, but not as a rule.

With regard to that the parking place is a surface source; it can under the unfavourable dispersion conditions (temperature inversion, low wind velocity) produce the relatively high air pollution.

Modelling of the air pollution from the static traffic

As it was shown sooner the collective garages minimize the negative impact of static traffic on the air pollution of the surroundings. The calculation of the air pollution from the collective garages is made by means of the method for the stationary sources. The collective garage is considered to be a point source, the height of which we can propose so that the impact will be minimal. In the case of a parking place it is not possible. The construction of the anti-noise barriers, eventually of the strip of the trees round the parking place could release its negative impact.

As a rule, we calculate the long-term pollutant concentration and maximal short-term (30 min.) concentration. There is no problem with the long-term pollutant concentration, because it is calculated over a long time interval (usually one year) and its value is low and usually not much higher than the background concentrations. For the evaluation of the negative impact of the parking place on the living area, the pollutant concentration for the most unfavourable meteorological conditions, under which the concentration is highest, is calculated – temperature inversion and the lowest wind velocity 1.0 $m.s^{-1}$.

For the calculation of maximum short-time pollutant concentration from the area source the relation is used:

$$C(x,y,0) = \frac{Q}{2\sqrt{2}U_s \sigma_z x_0}\left[erf\left(\frac{r_0 + y}{\sqrt{2}\sigma_y}\right) + erf\left(\frac{r_0 - y}{\sqrt{2}\sigma_y}\right)\right], \qquad (3)$$

where $r_0 = x_0 / \sqrt{\pi}$ is an effective radius, Q is the emission of the source,

$$\mathrm{erf}(p) = \frac{2}{\sqrt{\pi}} \int_0^p \exp\left(-\frac{t^2}{2}\right) dt$$

is the error function, U_s is the wind speed at 10 m and σ_z, σ_y are the vertical and horizontal "sigma" dispersion parameters.

A place for parking of one car has standard dimension 2.5m x 5.0m. To each place leads a 3 m wide road. Then the area for parking of one car is 20 m^2. The shape of a parking place is usually irregular. The calculation by the relation (3) assumes the square area. Therefore, it is necessary to divide the parking place into several square parts. We show as an example the huge parking place.

Parameters of the parking place:

Dimension 150m x 150m,

Capacity 1000 standings,

Working hours 18 hours.

Meteorological parameters:

(the most stabile) category of stability,

Wind speed 1.0 $m.s^{-1}$,

Urban dispersion mode

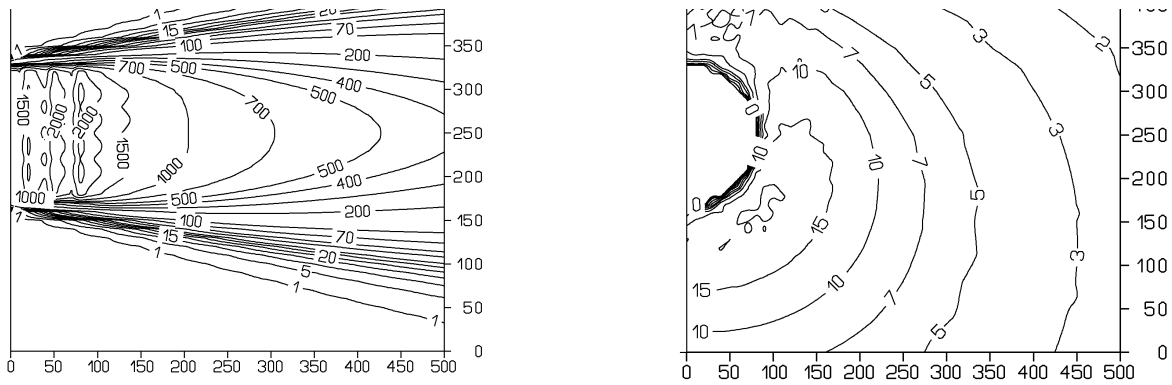
Emission of the parking place is given at the table below.

Table 5: Emission of the parking place

pollutant	emission ($g.s^{-1}$)	
	short-term	long-term
CO	2,75	2,0625
NO_x	0,105	0,07875
VOC	0,385	0,28875

The calculation of the distribution of long-term and short-term CO concentration is shown at the Figure 32.

Figure 34: The distribution of maximum short-term CO concentration [$\mu g.m^{-3}$] by the west wind after splitting the parking place into 25 x 25 parts and The distribution of long-term CO concentration [$\mu g.m^{-3}$] round the parking place



Similar as the busy road traffic also the static traffic can be the source of the excessive air pollution. Therefore, it is important to devote the adequate attention to this problem. It is necessary to obtain more exact enter parameters of the calculation method (time parking, time during that the cars have on the parking place started engines). It is also important to monitor the surroundings of the huge parking places and thus to verify and to specify the calculation method of air pollution from the static traffic.

8 Modelling and simulations

Urban models for transportation and spatial planning

Urban transport is essential for citizens to perform their daily activities, but at the same time constitutes one of the major sources of urban pollution (GHG emissions, local air quality, and noise), directly affecting citizens' health and well-being. Urban traffic produces 40% of CO2 emissions and 70% of emissions of other pollutants (CO, NOx, SOx, particulate matter) produced by road traffic. Traffic accidents are also increasing, with two thirds of the accidents and one third of the victims taking place in cities. The quest for environmentally sustainable urban transport, while ensuring competitiveness and addressing social concerns such as health problems or the needs of persons with reduced mobility, is a common and urgent challenge for all major cities in Europe (COM, 2009).

To tackle the challenge of sustainable urban mobility, urban planners need models, decision support tools, and input data allowing the assessment of policies and their resulting effects. Cities have been treated as systems for several decades, but only recently has the approach changed from aggregate equilibrium systems to complex, evolving systems of systems. Different types of urban models have been developed, from the static and aggregate land use-transportation interaction (LUTI) models first developed in the 1960s, to recent, bottom-up, activity-based microsimulation models which seek to represent cities in more disaggregate and heterogeneous terms (Batty, 1976, Batty 2007, Heppenstall et al. 2012).

In recent years, quantitative models for transportation and spatial planning have received a renewed attention. Urban development along the last two centuries has been driven by an increasing mobility of people and goods facilitated by relatively cheap energy. The growth of urban areas, the increasing concerns about sustainable development, and the challenges posed by energy scarcity and climate change, raise new questions such as the influence of higher transport costs on mobility and location (e.g. will distances to workplaces, shops, services and leisure be reduced?) or the impact of new policies (e.g. promotion of more efficient vehicles, transport demand management, anti-sprawl

legislation) aiming at fostering a more sustainable mobility and location behaviour (Wegener, 2010). In parallel, the emergence of new social media and electronic communications is leading to profound changes in social relationships, which is in turn modifying location and mobility patterns in cities. This new landscape makes it necessary to develop new models, tools, and methodologies enabling city governments and their citizens to design sustainable mobility policies.

Urban models serve various purposes. First, models help achieve an enhanced understanding of urban dynamics (in an explanatory role). Second, they enable virtual experimentation allowing the prediction of the impact of new infrastructures, technologies, or policies (in a predictive role). Finally, models are powerful tools to facilitate participatory processes for collaborative decision making (in policy and design roles). Despite significant effort carried out in the last two decades, urban models still require progress along several axes to fully satisfy these three objectives, and ultimately to support the assessment of urban mobility policies in terms of a comprehensive set of economic, social, and environmental sustainability indicators. Further research is needed in three main directions:

Data collection. Urban modelling is a data-intensive task. The development and validation of improved models critically relies on the availability of data.

Theoretical research - EURFORUM. On the transport demand side, many questions are still open, such as the social determinants of mobility behaviour, i.e. norms, social perception, age and demographic, personal security, or comfort; the activity patterns underlying human travel behaviour; the impact of information campaigns on user behaviour; the social acceptance of transport systems and mobility policies; the expectations that transport systems have to meet to be accepted and successful without inducing new travel needs; or the relationship between land use and transport demand. As for the transport supply side, research must be undertaken to investigate the potential of technology to supply integrated mobility services and transport systems.

Link between modellers, decision makers, and societal actors. The use of system models in policy making and planning is very heterogeneous. Many cities do not use any quantitative models at all; among the cities using simulation models, traditional LUTI models are still the most applied (Batty 1976). The use of more advanced, state-of-the-art models—particularly of agent-based models—for policy-making purposes is still scarce, and in many cases the potential users do not have the skills to use such models or are not convinced of the benefits. To bridge this gap, the development of the models needs to be user-driven and account for the requirements of the policy makers. The use of system models in a policy decision context will only be successful if the development of these tools is accompanied by user-model interaction methodologies and procedures facilitating a smooth integration into the decision-making processes (EUNOIA, 2012).

Challenges and opportunities

Despite the close interrelationship between land use and transportation, and the profound effects of such interaction on quality of life and the environment, in most urban areas of the world land use and transportation have historically been planned separately. Urban transportation planning has been the most active application area of simulation models, while land use planning has to a large extent been based on qualitative considerations and urban planners' experience, with computational land use models being used to a lesser degree than in transportation planning.

According to a recent survey of U.S. Metropolitan planning organisations (MPOs) with more than 200,000 residents (Lee, 2010), a few MPOs (7%) do not use any kind of modelling tool; 46% use transport-only models; and the remaining 47% use transport and land use models, though only 27% carries out an integrated planning. There have been various surveys in a European context, but the focus has been much less on models, and more on the use of ICT in planning agencies. This betrays the fact that most planning agencies are not engaged with the use of related urban models in their policy deliberations.

Depending on the size of the urban area and the available skills at the local level, standard four-stage models including logit choice of mode and destination choice are commonly employed. About 90% of the transportation demand models currently in use, either in an isolated manner or combined with land use models, are variations of the traditional four-step model; TRANSCAD, VISUM, and CUBE are the tools most widely spread. These models seem to satisfy the demands of the local and regional political processes, even if implemented less than optimally from a technical viewpoint (TRB, 2007).

Software PTV VISUM

PTV Visum is a comprehensive, flexible software system for strategic traffic and transport planning. The system is used for metropolitan, regional and state-wide infrastructure planning:

- Multimodal network modelling
- Tour-based and 4-step demand calculation
- Various static and dynamic assignment methods for private transport
- Two distinct public transport assignment procedures and operational planning modules
- Traffic engineering incl. signal time optimization
- Graphical and tabular analyses of results, output of reports
- Environmental impact evaluation methods
- Manager for the easy handling of various scenarios traffic

Impact Assessment of transport by module HBEFA (PTV VISUM)

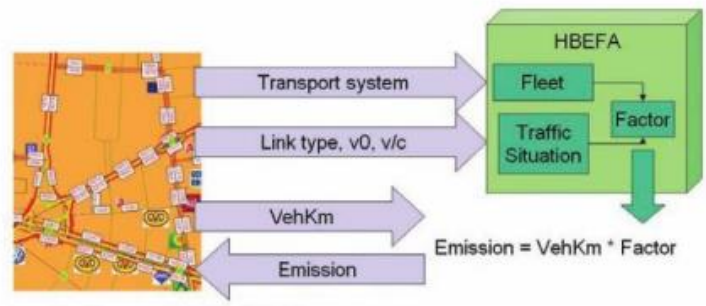
Why HBEFA?

This type of research project consumes vast resources, making a supranational approach desirable, and more than 10 years ago the German, Swiss, and Austrian environmental agencies pooled their resources to compile a comprehensive database of emission factors. The result was published as the Handbook of Emissions Factors (HBEFA). After several revisions, the HBEFA now faces the next major revision in which the emission factors will be updated to take into account new engine concepts and emission standards, including the findings from the EU-funded Artemis research project on transport emission models and systems.

ARTEMIS proposed a new set of systematic descriptors for traffic simulations that simplifies mapping from transportation models to emission models. Sweden, the UK, and France have now joined the HBEFA consortium, so that the revised HBEFA should eventually, become a truly European emission factors` standard. Against this background, VISUM developers toot the logical decision to make HBEFA3.1 the emission model to be integrated with VISUM.

Linking PTV`s Visum with HBEFA 3.1 will help planners to improve the increasingly important environmental assessment, through emissions calculation.

Figure 35: Data flow between VISUM and HBEFA



The basic approach for emission calculation follows a very straightforward equation:

Emission = Traffic Volume x Emission Factor *(4)*

In this equation emission stands for the total mass of a pollutant species such as CO_2 or NO_x emitted by the vehicles on a network link during a given time interval. The traffic volume is the number of vehicles that traverse the link within that time interval. Demand models, such as those developments in VISUM (PTV`s flexible software system for transportation planning, travel demand modelling, and network data management), yield traffic volumes, either as total or broker down by vehicle type such as cars, light trucks, and heavy trucks. These volumes are then multiplied by emission factors, the unit costs in emission modelling.

Obviously, emission factors are not constants, but functions of several factors. Speed, link type (such a s motorway versus city street), engine type, gradient, even temperature – all have a considerable impact. The functional relationship is determined through a vast amount of empirical work, measuring actual emissions in the field and in the lab, taking a variety of driving patterns into consideration (Nokel, Hoffmann, 2010).

Comparing traffic data

The scope of data types supported by PTV TrafficCountManagement includes both primary traffic-count data and environmental data. Pollution values for air pollutants such as NO_x, CO and PM emissions can be imported into the PTV TrafficCountManagement database for further evaluation. In particular, the visualization on the environmental data together with traffic volumes, or speed characteristics, enables users to evaluate relationships between the following two factors: the amount and speed of traffic.

In recent years, the effectiveness of traffic management has been judged on its impact on flow and on its contribution to the reduction of the traffic`s environmental footprint. This dual emphasis is likely to be increasingly important and the TrafficCountManagement is a comprehensive system to quantify these effects.

Figure 36: Emission analysis - centre of Žilina

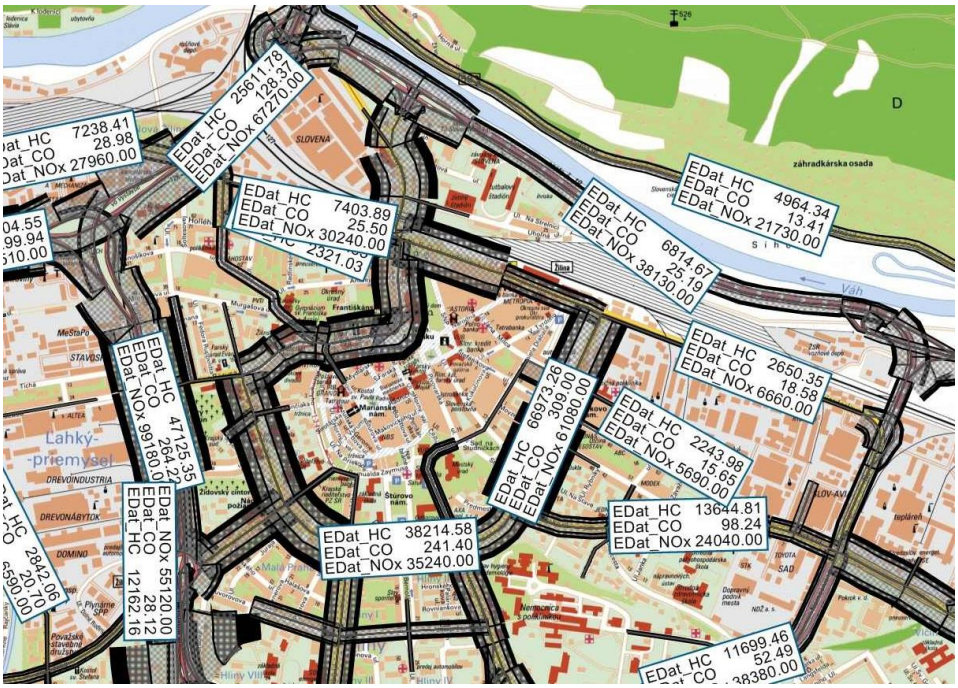
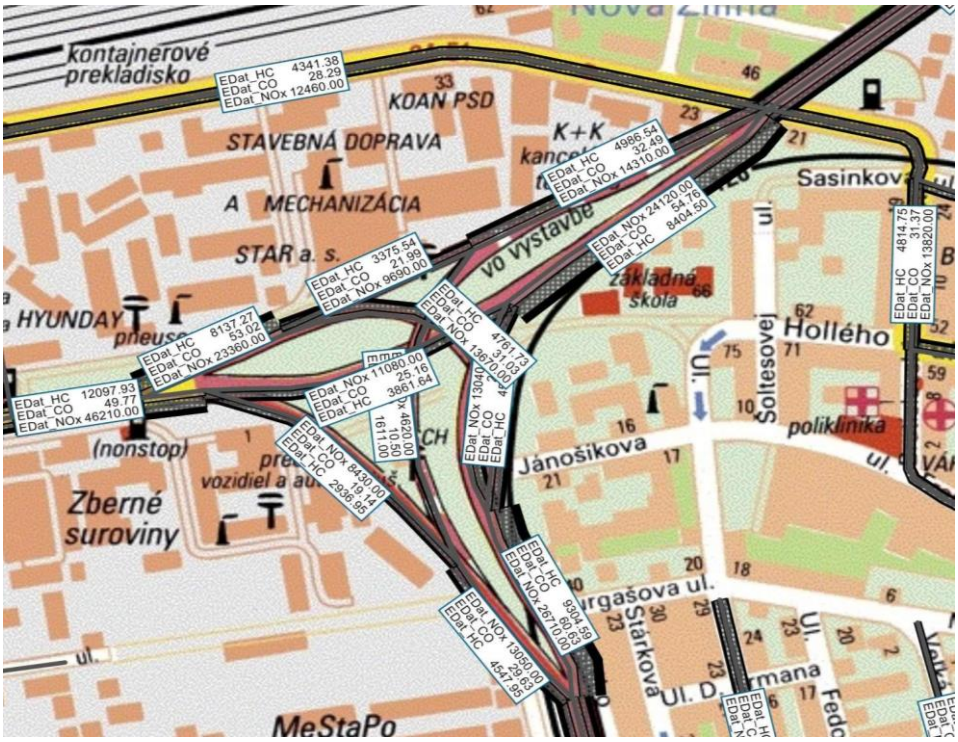
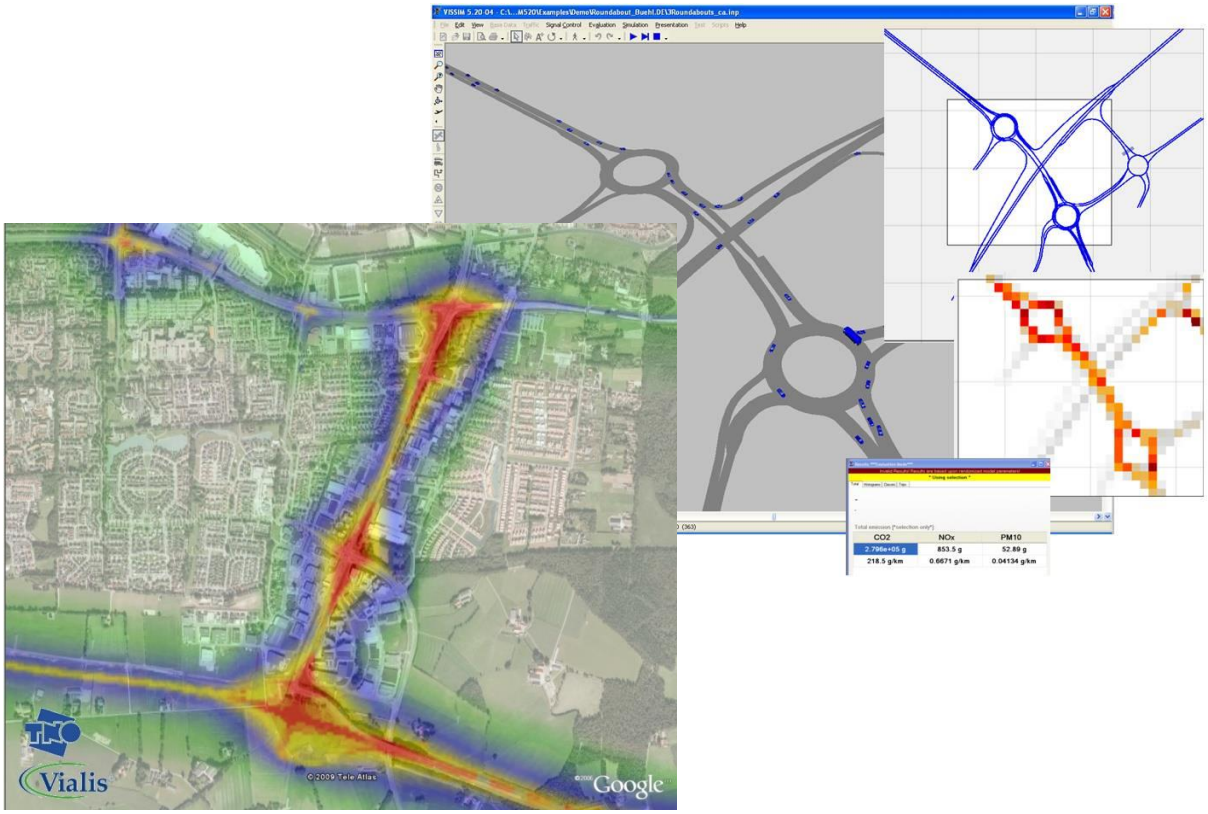


Figure 37: Emission Analysis - intersection in city Žilina



Source: Čelko, et al., 2010

Figure 38: Microsimulation – modul VISSIM EnViVER



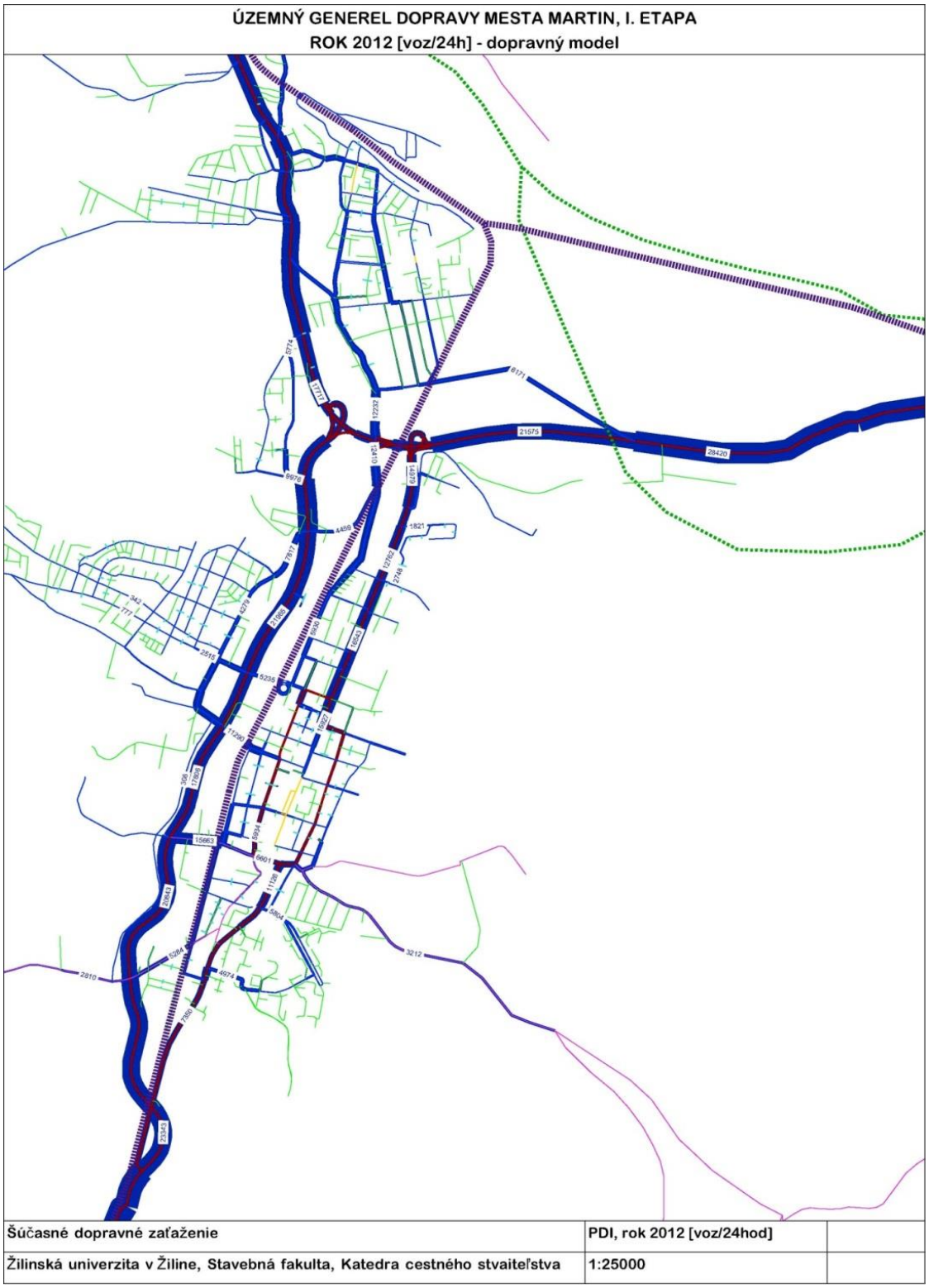
Examples from Slovak Towns

The establishment of transportation relations in a given territory is correctly perceived as a challenging task. It requires the interaction of all the parties involved in the creation of the land-use plan. The quality, extent and accessibility of input data should in the final analysis determine the quality of its outcomes. The manner of their compilation plays a significant role in the process of determination of transport relations. At present we can state that specialized programs for transport modelling bring a new dimension to the process of forming land-use plans. Their primary task is to define territorial modelling in greater detail and thus include in the calculation the largest possible number of effects.

<u>Transport solutions City Martin</u>

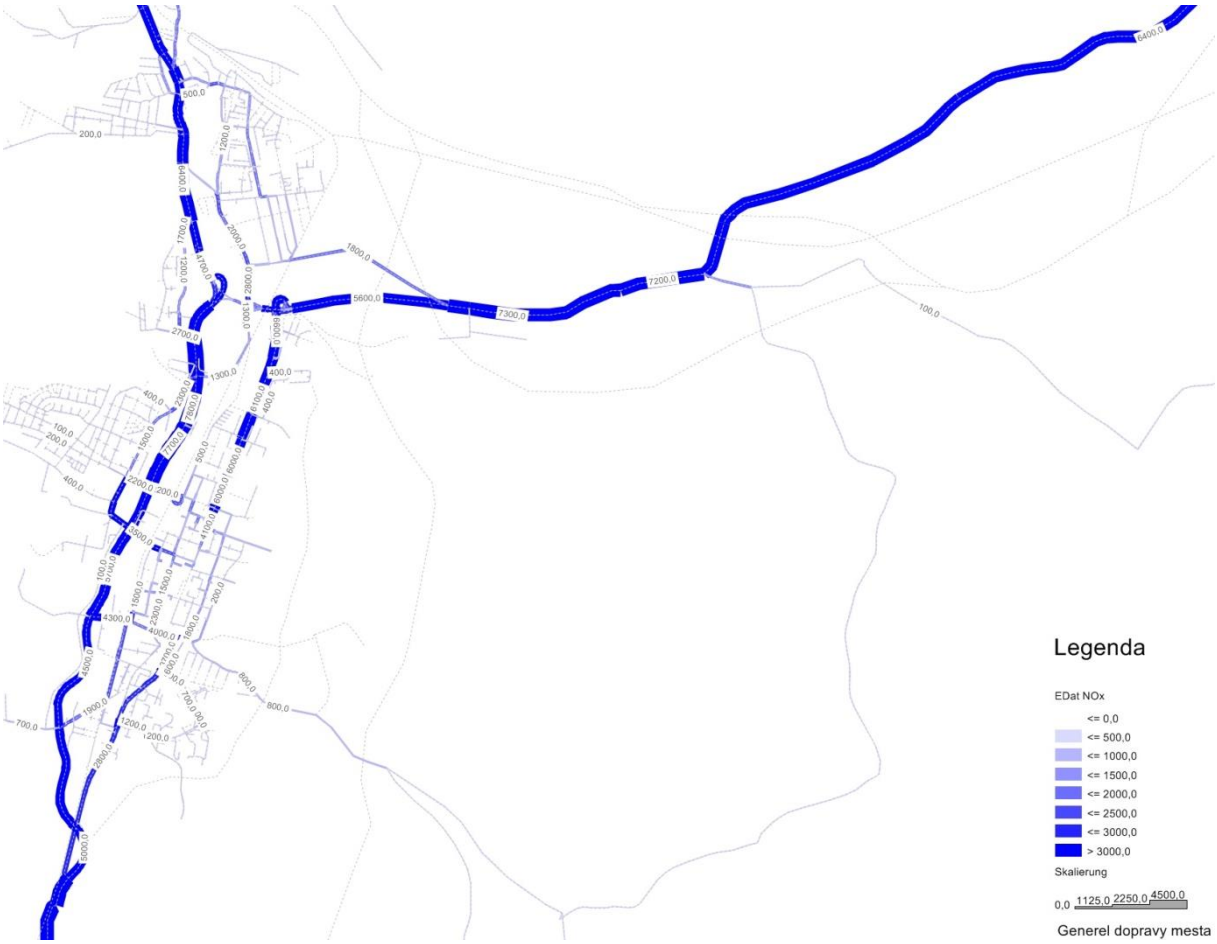
In the cities Žilina and Martin in the years 2010-2013 was processing traffic planning documentation. Dealt with the transport model city. There was compiled the traffic model of supply and demand model. These solutions are based on detailed traffic surveys. Based on these cities receive quality materials for transport solutions and solutions for sustainable development in the future.

Figure 39: Transport solutions City Martin



Source: Čelko et al., 2013

Figure 40: Air analysis – City Martin (Modul HBEFA)

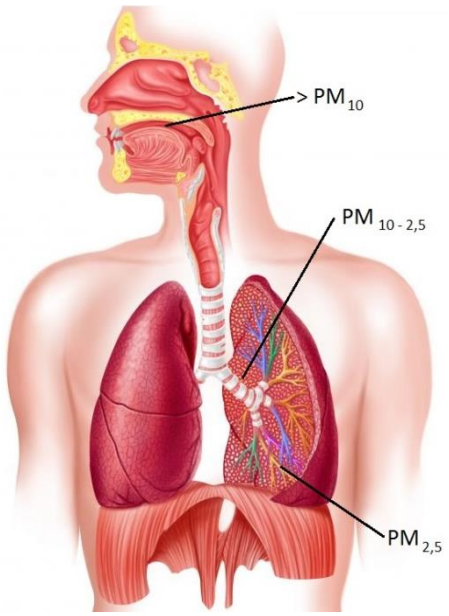


Source: Čelko et al., 2013

Quality of urban air – Monotiring Particulate matter and Heavy metal from traffic

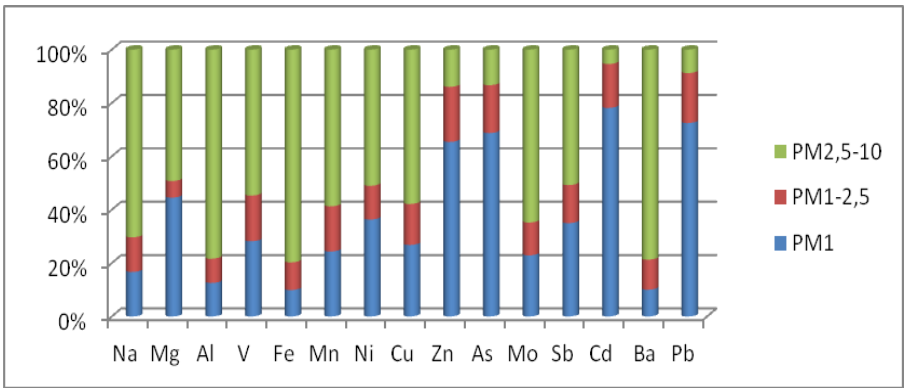
Readings of particulate matter are performed in the close vicinity of the urban connecting route, road in regular intervals, more specifically 4 times per year. The goal was a long-term monitoring of the proportional representation of particulate matter, particles in the ambient atmosphere and their behaviour with reference to the external conditions. In the second phase a chemical analysis of the particulates, particulate matter was performed in order to determine the amount of selected heavy metals in concerned fractions of PM.

Figure 41: Health impacts of PM



Source: EEA, 2013

Figure 42: Presence of metals in specific fractions of PM



Source: Ďurčanská & Jandačka, 2013

<u>Measures for reducing environmental impacts of transportation</u>

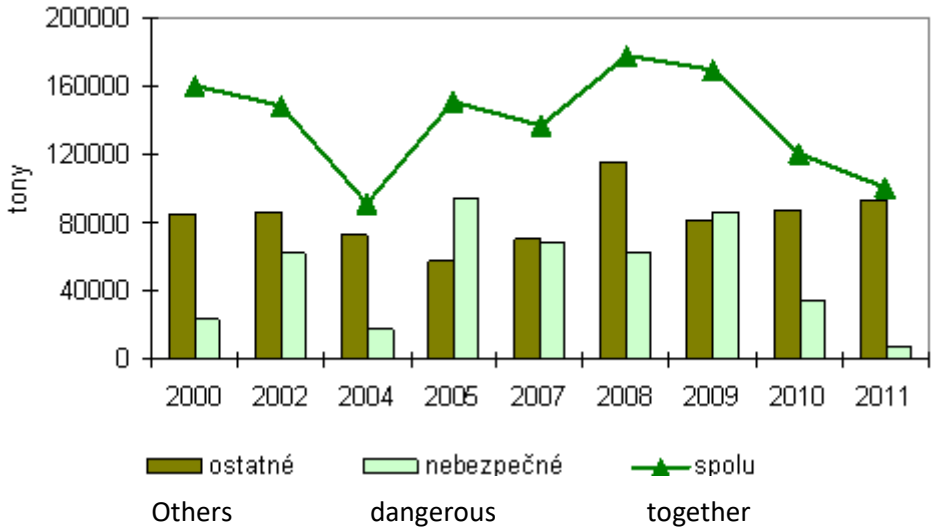
The measures for increasing environmental friendliness of transportation can be divided into the following categories:

Reducing air pollution (emissions) and noise from transportation

Reducing transportation`s effect on the structure and functions of the landscape (e.g. preferential development of track transportation, considerate placement of new routes and, as the case may be, the construction of ecoducts across highways near biocorridors)

Systemic and enviromentally friendly waste management (car wrecks, batteries, used motor oil)

Figure 43: Developments in waste within the transport sector (tones)



Source: SHMU, 2010

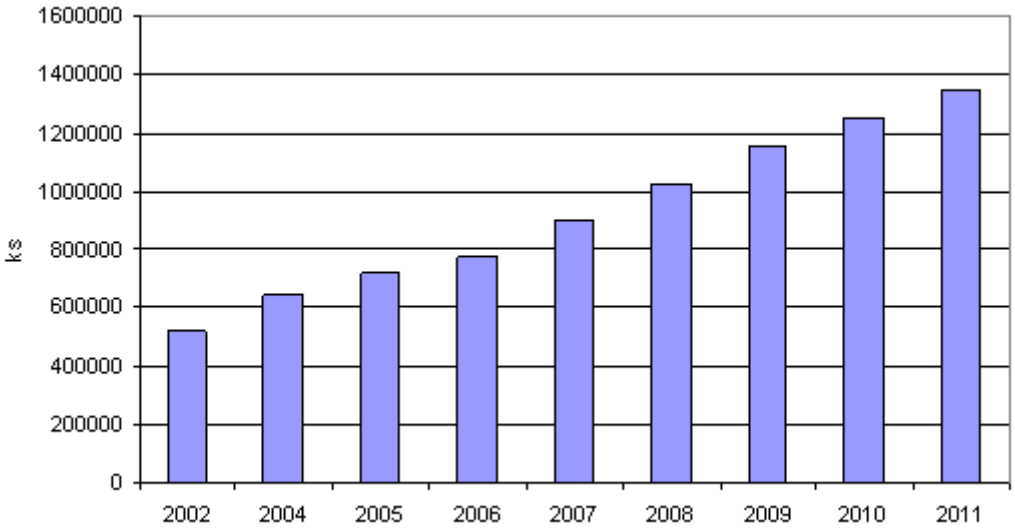
The measures can be of a technical character (e.g. the construction of anti-noise barriers, reduction of noise from rail transportation by installing flexible bedding for tracks or by reducing electrification of railway routes, the construction of ring roads around cities), a legislative character (e.g. emission limits for automobiles) or an economic character (taxes, charges, subsidies).

Emission limits specified by legislation are effective for the protection of fair quality. Such limits can only be met by fitting new automobiles with three-way catalytic converters. The share of these automobiles increased from 2002-2011 (see figure above).

Alternative methods for the propulsion of motor vehicles have yet to establish themselves. While the number of electric automobiles has stagnated, the number of LPG-powered passenger cars is the only figure to see any increase, with LPG use becoming more widespread in road freight transportation. The state uses lower excise tax rates to promote the production and consumption of environmentally friendly fuel types. The amount of this support, including the support for biodiesel through its placement under the lower Value Added Tax (VAT) rate, has fluctuated considerably.

The great majority of these measures depend on the economic condition of the state.

Figure 44: Number of passenger car in Slovakia fitted with catalytic converters



Source: SHMU, 2010

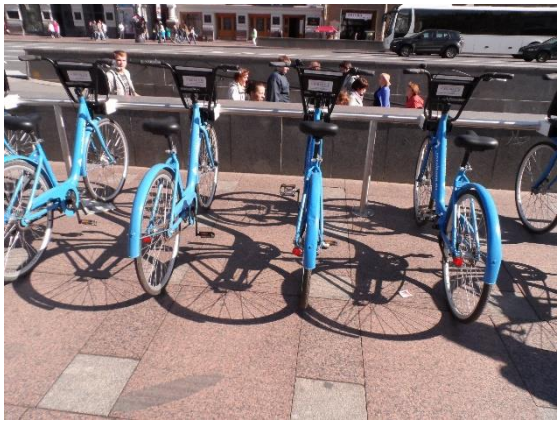
Today's rapidly expanding transportation demands are caused not only by new investments which increase the transit attractiveness of a region, but also by the increasing potential of traffic-producing areas. While such development is legal, it is also open to influencing. The purposed creation of land-planning documentation, its unequivocal maintenance, and long-term benefits and detriments analyses can create a symbiosis of all types of transportation and ensure the quality of the environment. Unfortunately, in our situation the positive influences run up against various interest groups and an overall lack of professionalism. Experience from more advanced countries however shows that effective solutions can indeed be put in place. What are the main transport problems in urban areas, and what are the possibilities for overcoming them?

Figure 45: La Défense, Paris – The entrance to the lower level and La Défense, Paris – center

Figure 46: Partial separation of public transport in Bordeaux and sharing transport area in Helsinki

Examples from the Netherlands, bicycle paths in Parma de Mallorca, Stockholm and urban bikes in St. Petersburg, they are in conditions off major Slovak cities so far only in long-term vision.

Figure 47: Bicycle communication in Stockholm and urban bikes in St. Petersburg



In neighboring countries is an essential part of every new project in built up areas the simulation of transportation movements after the project.

The transport is a phenomenon that significantly affects the life of the population. Ensure its functionality while protecting the environment and social environment in residential areas is a task that should be a priority for traffic planning activities.

Introduction of an environmental management system in oil and gas industry

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One of the main ways to achieve tangible results in reducing the negative impact of the oil and gas industry on the environment is the implementation of an effective environmental management system (EMS) at the enterprises of fuel-energy complex.

The environmental management system can be defined as the process and the catalytic activities of economic entities aimed at continual improvement to achieve their own environmental goals and objectives, based on independently of the adopted environmental policy taking into account the environmental performance of enterprises.

When developing, implementing and ensuring the effective functioning of the EMS management pursues the goal, arising from the Environmental policy of the enterprise:

- the compliance with environmental laws, rules and regulations for the protection of the environment;
- the division of powers and responsibilities of the personnel for the implementation of Environmental policy in accordance with the structural scheme of the administrative management of the company;
- the systematic environmental monitoring of all activities with the aim of continual improvement of the EMS;
- the recognition of the leading role of environmental requirements in policy making related to reconstruction, technical re-equipment and modernization of production facilities;
- the improvement of competence and awareness of Company personnel in the field of environmental protection, ensuring environmental safety and protection against emergencies.

Among other requirements, which are taken into account in the development of environmental policy include the following:

- the reflection of the guiding principles of the organization and focus on target-setting and planning environmental performance;
- the account of stakeholder expectations;
- the compliance with the nature, scale and environmental impacts of the organization's activities, products and services;
- the coordination with other aspects of the policies of the organization (e.g., quality, occupational health and safety);
- the establishment of a specialized Agency to determine and revision of goals and objectives in the field of environmental protection;
- the required documentation of environmental policy and maintaining it in working condition, ensuring the accessibility text for the staff and in the appropriate form to the public.

Enterprise's environmental performance characterized by:

1) the processes of production, including primary and support activities (education of waste, energy consumption, waste generation per unit of used raw materials, the specific accumulation of waste on the territory of the industrial site);
2) operation of the environmental management system and guidelines for its improvement;
3) reflect information about local, regional, and global environmental conditions or environmental conditions (change of marker parameters of environment-related activities of the organization).

Enterprise's environmental performance is presented in Figures 46, 47 and 48.

Figure 48: Indicators of environmental condition

Figure 49: System environmental performance of organizations (energy companies)

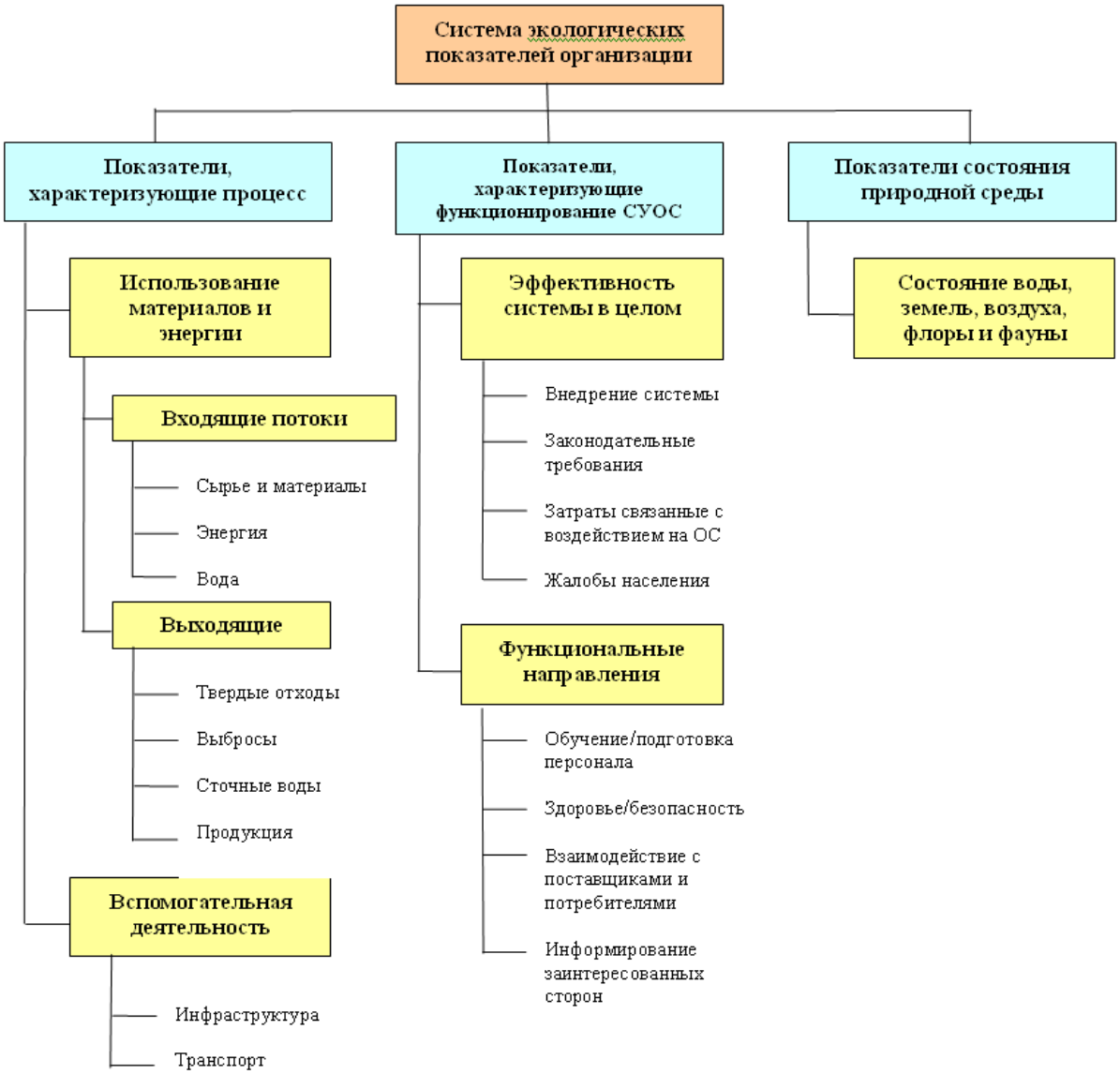
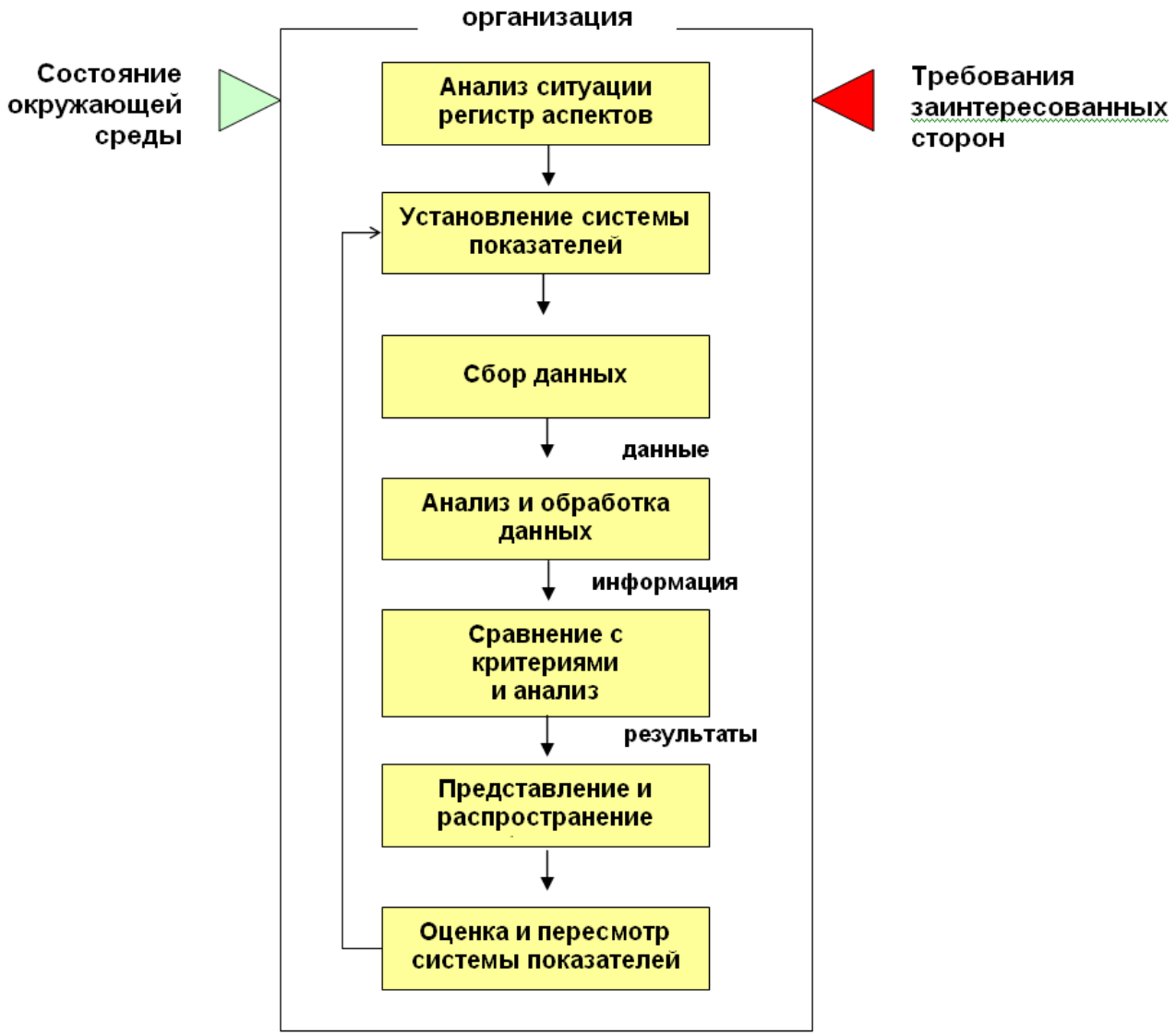


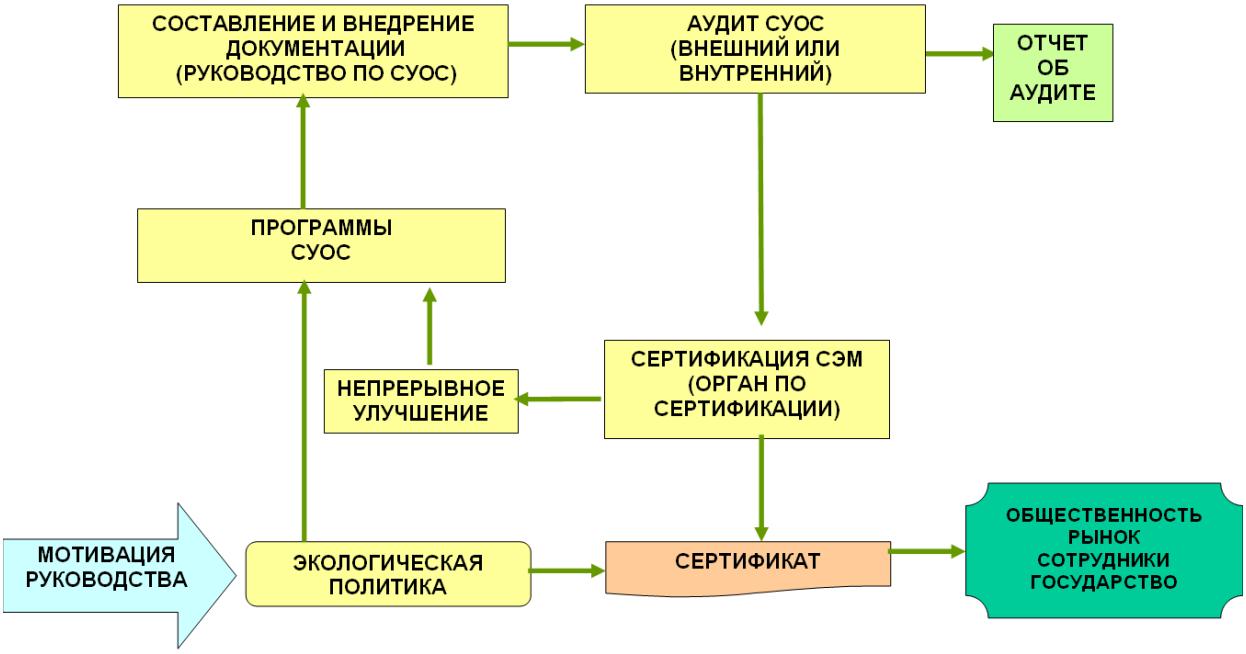
Figure 50: The Application of environmental indicators in EMS



Compliance with the EMS requirements is ensured by:

- the adaptation of the individual elements of the overall management system to the peculiarities of environmental management, in particular through the separation of functions and tasks between the units of the company, rights and obligations between specialists attached additions and modifications to the provisions of subdivisions and job descriptions;
- the mixing procedures and regulations development, implementation, application and updating EMS into a single structured process aimed at continuous improvement of the EMS.
- A sample implementation of environmental management systems in the oil and gas industry is shown in figure 49.

Figure 51: Diagram of the implementation of the environmental management system at enterprises of oil and gas complex



The parallels to Russian reality

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IRIS (International Railway Industry Standard) - International Railway Industry Standard specific for rail industry and is designed to evaluate business management systems. IRIS is fully compatible with the ISO 9001: 2008 and is related to ISO 9004:2009. The aim of this standard is to establish a business management system (BMS), which allows ensuring continuous improvement, focusing on prevention and reduction of the number of defects in the chain of supply of railway equipment. (IRIS, 2019)

The main tendencies of JSC “Russian Railways” in the field of strategic management of the quality of consumed products prove the need for the suppliers of JSC "Russian Railways" to meet the requirements of the IRIS standard. Meeting the IRIS standard requirements is expected to increase the competitiveness of railway engineering production and contribute to achieving the objectives stated in the strategy of railway transport development till 2030 and the development of transport engineering. (Vorobiev, Obukhova & Gurianov, 2011)

In the railway industry the IRIS standard requirements help rethink the business and build up an effective management system. The result is an integrated system of business management. Its integral parts include the management subsystems: strategic, financial, project and quality management. (Vorobiev, Obukhova & Gurianov, 2011)

Environmental audit in Russia is a relatively new type of activity. It is a new area in environmental management, so often businesses do not have the necessary knowledge about this procedure. Nevertheless, an environmental audit is becoming more widely spread.

Environmental audit is an independent, complex, documented assessment of compliance of economic and other entities with the requirements, including standards and regulations in the field of environmental protection requirements of international standards and recommendations to improve such activities (Article 1 of the Federal Law of 10.01. 2002 № 7-FZ “On Environmental Protection”). (http://www.consultant.ru/popular/okrsred/70_1.html#p45)

This kind of activity will help identify the preceding and current environmental problems and prevent future ones. The final stage of the environmental audit - is making recommendations to reduce the negative impact on the environment.

Environmental audit includes examination of the following activities (http://standartgost.ru):

- Compliance with environmental regulations in accordance with the legislation in the field of environmental protection, as well as with the requirements of the organization;
- Determining the level of sustainability of the company;
- Operation of the environmental management system;
- Obtaining environmental certification;
- Preparation of environmental declarations and reports about the company's environmental performance, and etc.
- The regulatory framework for environmental management and audit are the national standards developed on the base of ISO international standards:

- GOST R ISO 14001-2007 “Environmental Management Systems. Requirements with guidance for use” [http://standartgost.ru];
- GOST R ISO 14004-2007 “Environmental Management Systems. General guidelines on principles, systems and methods of operation” [http://standartgost.ru];
- GOST R ISO 19011-2012 “Guidelines for auditing management systems”.

Principles of environmental audit in accordance with GOST R ISO 19011-2012:

- integrity;
- impartiality;
- professional diligence;
- confidentiality - security of information;
- independence - the basis of impartiality and objectivity of the audit reports;
- evidence based approach is a reasonable basis for achieving reliable and reproducible audit reports in a systematic audit process.

Environmental audit tasks:

- foundation of environmental strategy and policy of the company;
- setting priorities when planning environmental activities of an enterprise, defining additional opportunities for its implementation;
- verification of compliance of a business entity with environmental legislation;
- improving the efficiency of controlling the impact of an economic entity on the environment;
- reducing the risk of emergencies related to environmental pollution.

There are the following types of environmental audit:

1. Compliance audit - determination of compliance of business with environmental legislation.
2. Management audit - assessment of management efficiency, compliance of the established corporate management system with the corporate policy, setting the degree of environmental risk associated with the activity of the enterprise.
3. Supply audit - the environmental assessment of raw materials and equipment used in the production process; identification of alternative resource-saving technologies that contribute to further reduction of the cost of the goods.
4. Real estate audit - evaluation of preceding economic damage from pollution, as well as prospective environmental liability.
5. Audit of waste management – risk assessment of production wastes through recovery, recycling, and burying.
6. Audit of energy - energy assessment and possible ways to reduce it.
7. Strategic Audit - assessment of prospective business strategy, taking into account the environmental performance of businesses and identification of potential business partners with an environmentally-oriented management system.
8. Insurance environmental audit - assessment of risk and the extent of damage as a result of man-made accidents, technical failures, natural disasters, etc. to support and implement environmental insurance.
9. Audit of accumulated damage - assessment of environmental hazard of the past accumulated damages of an enterprise or business during the transition to another kind of ownership.
10. Investment environmental audit - assessment of costs needed for environmental aspects when investing in reconstruction, expansion, conversion or plant closing down.

Stages of environmental audit

Stage 1. Pre-audit activities.

- Establishment of initial contact with the auditee (p.6.2.2 of GOST R ISO 19011-2012).
- Identification of audit possibility (6.2.3 GOST R ISO 19011-2012).
- Analysis of the documents to prepare for the audit (p.6.3.1 GOST R ISO 19011-2012).
- Audit planning (p.6.3.2 GOST R ISO 19011-2012).
- Selection of the audit team and distribution of activities among the audit team members (p.6.3.3 of GOST R ISO 19011-2012).
- Preparation of the working papers (p.6.3.4 GOST R ISO 19011-2012).

Stage 2. Preparations for on-site audit.

- Preliminary meeting (p.6.4.2 GOST R ISO 19011-2012).

The objectives of the preliminary meeting are:

a) confirmation of the consent of all parties involved (e.g. auditee, audit team) regarding the audit plan;
b) acquaintance with the members of the audit team;
c) ensuring that all events scheduled within the audit can be conducted.
d) Analysis of the documents within the audit procedure (p.6.4.3 GOST R ISO 19011-2012).
e) It is necessary to analyze the documentation of the auditee in order to:
f) determine the conformity of the system (as reflected in the documentation) with the audit criteria;
g) collect information to assist the implementation of the scheduled activities within the ongoing audit.

Auditors should determine whether the information provided in the documents (Annex B to the GOST R ISO 19011-2012) is:

- complete (the documents contain all the required information);
- correct (the contents of the documents are in the line with other reliable sources, such as standards and regulations);
- compatible (provisions of the document are consistent with each other and related documents);
- relevant (provisions contained in the documents are valid at the time of audit).
- Collection and verification of information (p.6.4.6 GOST R ISO 19011-2012).
- Formation of the audit findings (p.6.4.7 GOST R ISO 19011-2012).
- Preparation of opinions on audit results (p.6.4.8 GOST R ISO 19011-2012).
- Closing meeting (p.6.4.9 GOST R ISO 19011-2012).

Stage 3. Preparation and dissemination of the audit report.

- Preparation of the audit report (p.6.5.1 GOST R ISO 19011-2012).
- Dissemination of the audit report (p.6.5.2 GOST R ISO 19011-2012).

Stage 4. Completion of the audit.

The audit is considered to be complete when all the scheduled audit activities are carried out; any changes are to be agreed with the audit client. For example, there may be unforeseen situations that prevent the audit from being completed according to the plan (6.6 of GOST R ISO 19011-2012).

Stage 5. Post-audit activities.

Depending on the audit objectives the findings may require taking corrections, corrective and preventive measures or improvements. Such measures are usually worked out and taken by the auditee within the agreed timeframe. If required, the auditee is to inform the person responsible for the audit procedure, auditors' team about the course of implementation of these measures (p.6.7 GOST R ISO 19011-2012).

Within the period 2008-2010, there was an environmental audit of JSC "Russian Railways" to evaluate its compliance with the environmental management requirements of environmental legislation of the Russian Federation, environmental management system of international standard GOST R ISO 14001. 433 line enterprises of the branches of JSC "Russian Railways" were audited.

In 2011, 70 structural units of 11 branches, responsible for high-speed traffic on the Moscow - St. Petersburg line were certified for compliance with GOST R ISO 14001.

In 2012 and 2013 the certification body tested them for compliance with GOST R ISO 14001 "Environmental Management Systems".

In 2010-2013 a set of basic environmental documents was developed in order to improve the efficiency of environmental management system of JSC "Russian Railways". They cover all environmental issues including energy efficiency and innovative development. Among the basic ones are:

- Strategy of Innovative Development of JSC "Russian Railways" up to 2030 ("White Paper" of JSC "Russian Railways", approved on October 26, 2010);
- Energy Strategy of the holding "Russian Railways" up to 2015 and up to 2030 (Regulation of JSC "Russian Railways" dated December 15, 2011 N 2718r);
- Functional strategy of risk management in the holding "Russian Railways" (Regulation of "Russian Railways" dated July 26, 2012 N 1494r);
- The concept of development of environmental management of the holding "Russian Railways" holding (Regulation of JSC "Russian Railways" dated August 6, 2012 1575r N);
- The development strategy of the holding "Russian Railways" for the period till 2030 (Minutes of the Board of JSC "Russian Railways" from August 26, 2013 N 24);
- Policy of the holding "Russian Railways" in the field of occupational safety and environmental protection, industrial and fire safety (Minutes of the Board of JSC "Russian Railways" from November 25, 2013 N 39);
- A set of measures aimed at raising environmental responsibility of JSC "Russian Railways" (Minutes of the Board of Directors of JSC "Russian Railways" from September 28, 2012 N 15).

Russia has also adopted new standards GOST R ISO 19011-2012

Guidelines for auditing management systems. It was approved and put into effect by the order of the Federal Agency for Technical Regulation and Metrology on July 19, 2012 № 196-st.)

GOST R ISO 14001-2016 Environmental Management Systems. Requirements with guidance for use. It was approved and put into effect by the order of the Federal Agency for Technical Regulation and Metrology on April 29, 2016 N 285-st. (Lukenyuk E.V., Lukenyuk A.I., Anfilofiev B.A. (2013)

Within the realization of the Environmental strategy of JSC "Russian Railways" up to 2015 and up to 2030, approved by the order of JSC "Russian Railways" on February 13, 2009 N 293r (hereinafter - the Environmental Strategy 2009) the following results were achieved during the period from 2008 to 2013 as compared with 2007 (baseyear):

- Reduction of harmful emissions into the atmosphere from stationary sources by 43%;
- Reduction of greenhouse gas emissions by 11%;
- Reduction of discharges of polluted wastewater into surface water bodies by 26%;
- Increase of waste treatment by 14.7% of the total production.

Dynamics of reduction of harmful emissions into the atmosphere, reduction of the volume of water consumption, wastewater and increase in waste treatment share of the total production are the results of successful implementation of investment projects, improvement of environmental management system and raising of environmental responsibility of JSC "Russian Railways".

Within the realization of the Environmental strategy of JSC "Russian Railways" the following problems are to be solved in any case:

1) In the field of air protection:

- Reduction of harmful emissions into the atmosphere from stationary sources, including greenhouse gas emissions;
- Reduction of harmful emissions into the atmosphere from mobile sources, including emissions of greenhouse gases.

2) In the field of noise protection:

- Reduction of noise impact on the environment, primarily within the settlements.

3) In the field of protection and rational use of water resources:

- Prevent or reduce wastewater discharge (discharge in violation of standards) to surface waters, on the terrain and to the municipal sewer system.

4) In the field of protection and rational use of land:

- Taking measures aimed at preventing negative (adverse) effects of production activity of JSC "Russian Railways", eliminating consequences of land pollution.

5) In the area of waste production and treatment:

- Involvement of waste into economic cycle as additional sources of raw materials;
- Introduction of the best available environmental technology of waste treatment and disposal.

6) Elimination of the objects of accumulated environmental damage associated with past economic activities.

7) In the field of resource:

- Improving energy efficiency, reduction of material processes, increasing productivity.

8) In corporate environmental management:

- Implementation of common principles and standards of corporate environmental management in JSC "Russian Railways", relevant to the Russian environmental legislation,

GOST R ISO 14001-2007 (ISO 14001: 2004), criteria for ranking of 500 environmentally friendly companies in the world (according to Newsweek magazine);
- Reducing the risk of accidents and increase of efficiency in dealing with environmental consequences of accidents;
- Increasing environmental requirements for rolling stock, fuel, transport infrastructure;
- Providing industrial environmental control, improving the practice of environmental audits;
- Improving economic efficiency of environmental activities. (Environmental Strategy of JSC "Russian Railways" up to 2017 and up to 2030, 2014).

The key terms used in the environmental audit are given in the glossary on the basis of GOST R ISO 19011-2012 Guidelines for auditing management systems (http://gostexpert.ru/gost/gost-19011-2012)

Auditor is a person who performs an audit.

Audit team is one or more auditors engaged in audit supported by technical experts if necessary. One of the auditors in the audit team is usually appointed the head of the group. The audit team may include auditors-in-training.

Technical expert is a person possessing special knowledge or experience required by the audit team. Specific knowledge or expertise includes knowledge or experience related to the organization, process or activity audited, as well as knowledge of the language and culture of the country in which an audit is performed. Technical expert has no auditor authority in the audit team.

Audit client is an organization or a person who contracted the audit.

Observer is a person accompanying the audit team, but not performing an audit. An observer may be a representative of the audited entity, the supervisory authority or other party concerned who oversees environmental audits. An observer is not a member of the audit team and does not affect or interfere with the audit procedure.

Audit program is a set of activities for one or more audits planned for a specific time frame and aimed at a specific purpose.

Audit criteria include a set of policies, procedures or requirements used as a standard; the audit evidence is compared to it. If the audit criteria are legal requirements (including legislative or regulatory requirements), the audit reports (observations) often contain the terms “appropriate” or “inappropriate”.

Audit evidence includes recordings, statements of fact or other information that is related to the audit criteria and is verifiable.

Auditor's report (results of an environmental audit) is the outcome of the audit after considering the audit objectives and all conclusions.

Infrastructure Planning and Environmental Protection

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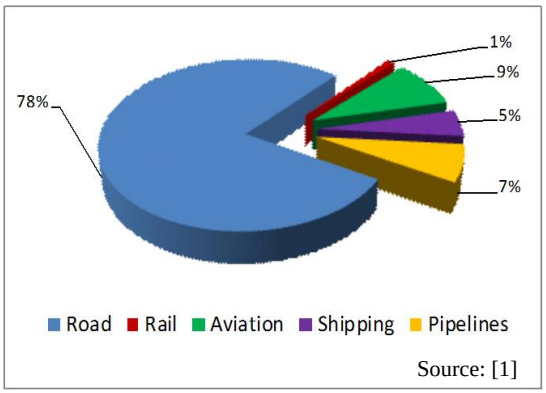
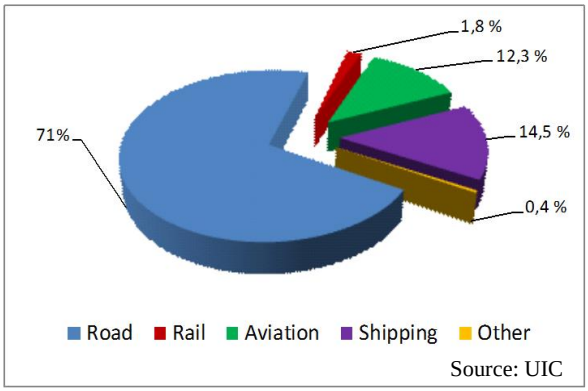
The role of transport in the life of every person on the planet is huge, but talking about the impact of different modes of transport on a man and his environment, it should be noted that this effect varies widely (Figure 50 a and b).

Figure 52: CO_2 emissions of different transport modes a) in Russia (K.Alexandrova. 2014. The links of one Chain. The RZD Partner International. 3(39), p.38-39) b) in EU



a)



b)

For example, the most negative impact of carbon dioxide emissions comes from road transport, and minimal impact on the environment has rail transport and this trend is typical both for Russia and Europe (Figure 50, b). But air pollution – not the only one negative effect of transport on the environment, a partial list of the problems caused by motor transport in Russian cities is shown in Table 6 (Morozov, 2014).

Table 6: Problems caused by motor transport in cities of Russia

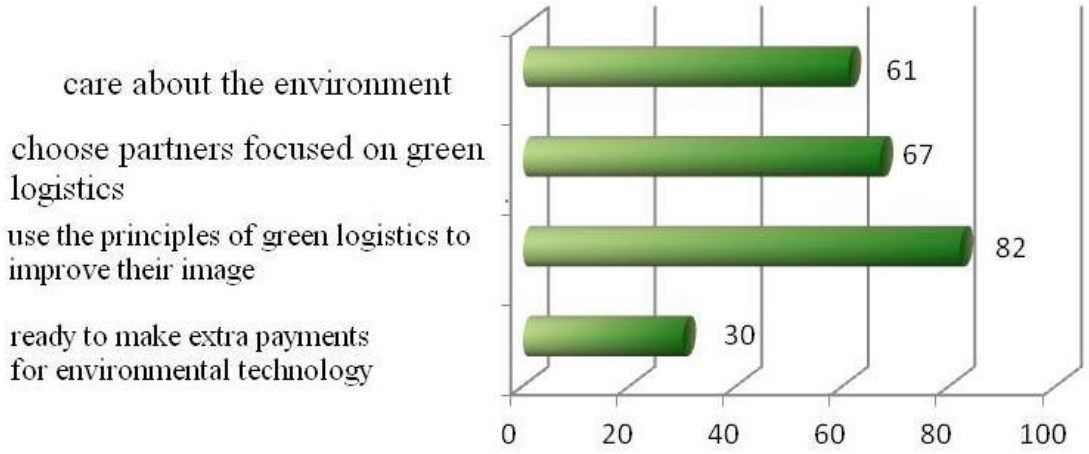
item №	Problem	Consequences
1.	Air and water pollution in the cities of the Russian Federation (up to 80% of air pollution in the city is accounted for vehicles).	Reduction in life expectancy of the citizens by an average of 4 years. Extra load on public health service.
2.	Road network, built and maintained at the expense of all city residents.	City residents receive less public goods.
3.	Free parking on the streets and in the yards for more than a half of private cars.	The disadvantage of blocking the yards and sidewalks by parked cars.

4.	Providing service for the conservation of lawns, playgrounds, etc.	Additional funds from the budget for the installation of fences, restoration of lawns, etc.
5.	Urban area cleaning from motor vehicles dirt, 85% of which falls on rubbed asphalt surface by spikes of winter tires.	Spikes rub away about 5 mm of asphalt covering per year, and it is more than 50 tons of toxic dust.
6.	The noise level generated by motor vehicles is stable in range of 85-90 dBA.	Negative impact of city noise on man is 36% more significant than of smoking tobacco, life expectancy is reduced by 10-12 years.

According to the table it is easy to conclude the feasibility of rail transport development. That is why today Green Logistics is mainly a shift of freight and passenger traffic from trucks to railway.

More and more companies are now turning to green logistics. The analysis carried out by QSHE Global (Alexandrova, 2014) showed the attitude of respondents (5,400) towards the introduction of environmental technologies in business processes of modern companies (Figure 51).

Figure 53: The survey of QSHE Global



But despite the seemingly obvious conclusion about the appropriateness of the priority development of rail transport, however, many countries have invested and continue to actively invest huge funds in the development of road infrastructure. For example, China over the past 10 years had built about 50 thousand kilometers of roads, and by 2020 it is planned to reach the target of 85 thousand kilometers. In the US the total length of federal roads today is about 73 thousand kilometers. India in the next five years is going to renovate completely its road network and puts into use about 20 km of roads every day. (http://www.autodesk.ru/adsk/servlet/pc/item?siteID=871736&id=15667376).

Of course, transportation by motor transport has several advantages; the main one is the ability to deliver small quantities of goods on the «door-to-door» principle. In addition, paying attention to the

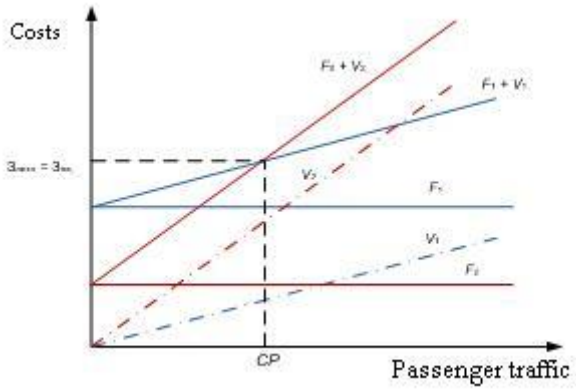
economic side of the issue, it should be noted that each type of transport has its own optimum operating range. For example, at short distances (150 - 200 km) and a small cargo or passenger traffic railway transport is difficult and often impossible to compete with motor transport (Zhuravskaya, Kazakov & Parsyurova, 2012). On placement of stopping points for multimodal passenger transport. (Zhuravskaya et. al., 2012). Effective action range of vehicles is determined by the CP (change point) - point of change scenario of transport service, which is calculated by the formula (1),

$$CP = \frac{F_1 - F_2}{V_2 - V_1}, \qquad (1)$$

where F1 and F2 - common fixed costs of the first and second modes respectively;

V1 and V2 - variable costs of these same modes of transport (Figure 52).

Figure 54: The relation between the volume of shipments and transportation costs when choosing a mode of transport.



The graph shows that the freight- or passenger traffic that falls in the range from 0 to the CP point is economically profitable to be transported by road. Green logistics task of reducing the adverse impact of vehicles on the urban environment turns into the problem of integration of different modes of transport.

Measures may be of organizational and technological nature, such as the interaction of different modes of transport, with a minimum of vehicles, i.e. organization of multimodal or intermodal transport.

One of the kinds of intermodal transport is piggybacking. Piggyback (contrail) transportation - is combined rail and road transport, in which a trailer, a semitrailer, or swap body are transported on a railway platform (Zhuravskaya, 2013).

Piggyback transportation is in successful operation in Europe for over 30 years, with increasing the railway component each year. It is the planned to transfer 30% of all existing road freight traffic to railway by 2030, and by 2050 - 50%.

When analyzing the possibilities of a piggyback transportation in Russia it should be noted that in the first place they will be interesting to the railroad, as most of the way in a piggybacking in Russia accounts for the railroad. As an example of multimodalism in Russia we present a pilot project of piggyback transportation in Russia with the participation of JSC "Russian Railways" on the route "Ekaterinburg-Moscow". The project includes economic and technological rationale for piggyback organization and a set of measures aimed at increasing the attractiveness of this mode of transport in terms of environmental safety.

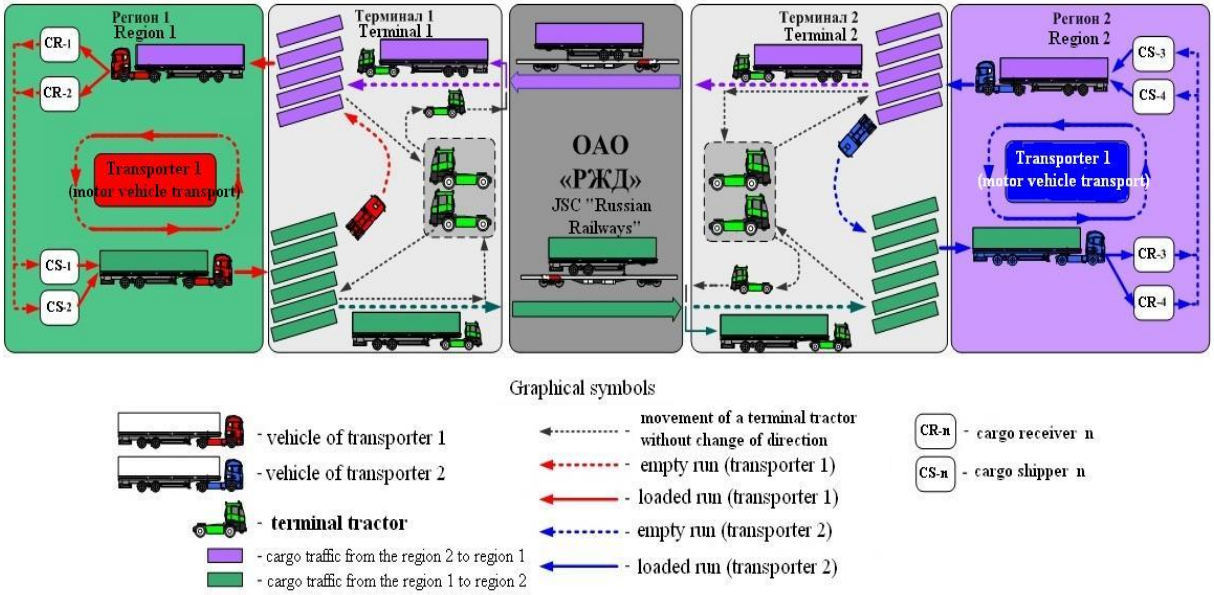
This project studied modern logistics technology of piggyback transportation in the EU and inspected the possibility of using the best international experience to Russian conditions. We developed a classification matrix for piggyback systems technologies taking into account the different ways of vehicular loading vehicles on railway platforms (Table 7).

Table 7: Matrix of classes of piggyback technology

Application of mechanic means	*Plane of loading and unloading works*	
	H (eng.«*horizontal*»)	**V** (eng.«*vertical*»)
S (eng.«*self*»)	***SH-1*** («Modalohr»)	-
	SH-2 («MegaSwing»)	-
	SH-3 («ROLA»)	-
M (eng.«*mechanization»)*	***MH-1*** («CargoBeamer»)	***MV-1*** («Kombiverkehr»)

The possibility of introducing a technology in the Russian context defines a number of factors that cannot be ignored because of the nature of the transport system and economics of Russia. It is obvious that not all piggyback technologies used in the EU will effectively assimilate into Russian conditions, so the authors are encouraged to use the simplest and economically effective method of loading and unloading using containers. The method is based on the possibility of driving on the platform from any angle and from any direction, since it is supposed to have a special terminal infrastructure - an elevated site, located in the same level with the floor of the car, with the minimum clearances from the side of the platform. According to the introduced classification this type of implementation of the loading and unloading works belongs to the «SH» class, subclass 4. Workflow of piggyback terminal with "shunting" trucks is shown in Figure 53.

Figure 55: Schematic diagram of the organization of freight traffic using piggyback technologies in Russia.



Piggyback transportation is a relatively new product for Russian railways, it is interesting in terms of technology and logistics, and is able to strengthen the status of JSC "Russian Railways" as a company focused on green technology and green logistics.

Risk management according to ISO 31000

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Organizations of all types and sizes face internal and external factors and influences that make it uncertain whether and when they will achieve their objectives. The effect this uncertainty has on an organization's objectives is «risk».

Although the practice of risk management has been developed over time and within many sectors in order to meet diverse needs, the adoption of consistent processes within a comprehensive framework can help to ensure that risk is managed effectively, efficiently and coherently across an organization. The generic approach described in this International Standard provides the principles and guidelines for managing any form of risk in a systematic, transparent and credible manner and within any scope and context.

All activities of an organization involve risk. Organizations manage risk by identifying it, analysing it and then evaluating whether the risk should be modified by risk treatment in order to satisfy their risk criteria. Throughout this process, they communicate and consult with stakeholders and monitor and review the risk and the controls that are modifying the risk in order to ensure that no further risk treatment is required. ISO 31000 describes this systematic and logical process in detail. (IS0 31000, 2009)

1 Introduction

Each specific sector or application of risk management brings with it individual needs, audiences, perceptions and criteria. Therefore, a key feature of ISO 31000 is the inclusion of “establishing the context” as an activity at the start of this generic risk management process. Establishing the context will capture the objectives of the organization, the environment in which it pursues those objectives, its stakeholders and the diversity of risk criteria – all of which will help reveal and assess the nature and complexity of its risks.

When implemented and maintained in accordance with ISO 31000, the management of risk enables an organization to, for example (IS0 31000, 2009):

- increase the likelihood of achieving objectives;
- encourage proactive management;
- be aware of the need to identify and treat risk throughout the organization;
- improve the identification of opportunities and threats;
- comply with relevant legal and regulatory requirements and international norms;
- improve mandatory and voluntary reporting;
- improve governance;
- improve stakeholder confidence and trust;
- establish a reliable basis for decision making and planning;
- improve controls;
- effectively allocate and use resources for risk treatment;

- improve operational effectiveness and efficiency;
- enhance health and safety performance, as well as environmental protection;
- improve loss prevention and incident management;
- minimize losses;
- improve organizational learning; and
- improve organizational resilience.

ISO 31000 is intended to meet the needs of a wide range of stakeholders, including (IS0 31000, 2009)**:**

a) those responsible for developing risk management policy within their organization;
b) those accountable for ensuring that risk is effectively managed within the organization as a whole or within a specific area, project or activity;
c) those who need to evaluate an organization's effectiveness in managing risk; and
d) developers of standards, guides, procedures and codes of practice that, in whole or in part, set out how risk is to be managed within the specific context of these documents.

The current management practices and processes of many organizations include components of risk management, and many organizations have already adopted a formal risk management process for particular types of risk or circumstances. In such cases, an organization can decide to carry out a critical review of its existing practices and processes in the light of ISO 31000.

ISO 31000 can be applied throughout the life of an organization, and to a wide range of activities, including strategies and decisions, operations, processes, functions, projects, products, services and assets. This International Standard can be applied to any type of risk, whatever its nature, whether having positive or negative consequences.

In ISO 31000, the following terms and definitions apply (IS0 31000, 2009):

- ***Risk*** as effect of uncertainty on objectives. An effect is a deviation from the expected — positive and/or negative. Objectives can have different aspects (such as financial, health and safety, and environmental goals) and can apply at different levels (such as strategic, organization-wide, project, product and process). Risk is often characterized by reference to potential events and consequences or a combination of these. Risk is often expressed in terms of a combination of the consequences of an event (including changes in circumstances) and the associated likelihood of occurrence. Uncertainty is the state, even partial, of deficiency of information related to, understanding or knowledge of an event, its consequence, or likelihood.

- ***Risk management*** represents coordinated activities to direct and control an organization with regard to risk.

- ***Risk management framework*** as a set of components that provide the foundations and organizational arrangements for designing, implementing, monitoring, reviewing and continually improving risk management throughout the organization. The foundations include the policy, objectives, mandate and commitment to manage risk. The organizational arrangements include plans, relationships, accountabilities, resources, processes and activities. The risk management framework is embedded within the organization's overall strategic and operational policies and practices.

- ***Risk management policy*** as a statement of the overall intentions and direction of an organization related to risk management.

- ***Risk owner*** as a person or entity with the accountability and authority to manage a risk.
- ***Risk management process*** as a systematic application of management policies, procedures and practices to the activities of communicating, consulting, establishing the context, and identifying, analysing, evaluating, treating, monitoring and reviewing risk.
- ***External context*** as the environment in which the organization seeks to achieve its objectives. External context can include:
    - the cultural, social, political, legal, regulatory, financial, technological, economic, natural and competitive environment, whether international, national, regional or local;
    - key drivers and trends having impact on the objectives of the organization; and
    - relationships with, and perceptions and values of external stakeholders.
- ***Internal context*** as the environment in which the organization seeks to achieve its objectives. Internal context can include:
    - governance, organizational structure, roles and accountabilities;
    - policies, objectives, and the strategies that are in place to achieve them;
    - the capabilities, understood in terms of resources and knowledge (e.g. capital, time, people, processes, systems and technologies);
    - information systems, information flows and decision-making processes (both formal and informal);
    - relationships with, and perceptions and values of, internal stakeholders;
    - the organization's culture;
    - standards, guidelines and models adopted by the organization; and
    - form and extent of contractual relationships.
- ***Stakeholder*** as a person or organization that can affect, be affected by, or perceive themselves to be affected by a decision or activity. A decision maker can be a stakeholder.
- ***Risk assessment*** as an overall process of risk identification, risk analysis and risk evaluation.
- ***Risk identification*** as a process of finding, recognizing and describing risks. Risk identification involves the identification of risk sources, events, their causes and their potential consequences. Risk identification can involve historical data, theoretical analysis, informed and expert opinions, and stakeholder's needs
- ***Likelihood*** as a chance of something happening. In risk management terminology, the word “likelihood” is used to refer to the chance of something happening, whether defined, measured or determined objectively or subjectively, qualitatively or quantitatively, and described using general terms or mathematically (such as a probability or a frequency over a given time period). The English term “likelihood” does not have a direct equivalent in some languages; instead, the equivalent of the term “probability” is often used. However, in English, “probability” is often narrowly interpreted as a mathematical term. Therefore, in risk

management terminology, “likelihood” is used with the intent that it should have the same broad interpretation as the term “probability” has in many languages other than English.

- ***Risk analysis*** as a process to comprehend the nature of risk and to determine the level of risk. Risk analysis provides the basis for risk evaluation and decisions about risk treatment. Risk analysis includes risk estimation.
- ***Level of risk*** as a magnitude of a risk or combination of risks, expressed in terms of the combination of consequences and their likelihood.
- ***Risk evaluation*** as a process of comparing the results of risk analysis with risk criteria to determine whether the risk and/or its magnitude is acceptable or tolerable. Risk evaluation assists in the decision about risk treatment.
- ***Risk treatment*** as a process to modify risk. Risk treatment can involve:
    - avoiding the risk by deciding not to start or continue with the activity that gives rise to the risk;
    - taking or increasing risk in order to pursue an opportunity;
    - removing the risk source;
    - changing the likelihood;
    - changing the consequences;
    - sharing the risk with another party or parties (including contracts and risk financing); and
    - retaining the risk by informed decision.

Risk treatments that deal with negative consequences are sometimes referred to as “risk mitigation”, “risk elimination”, “risk prevention” and “risk reduction”. Risk treatment can create new risks or modify existing risks.

For risk management to be effective, an organization should at all levels comply with the principles in Table below.

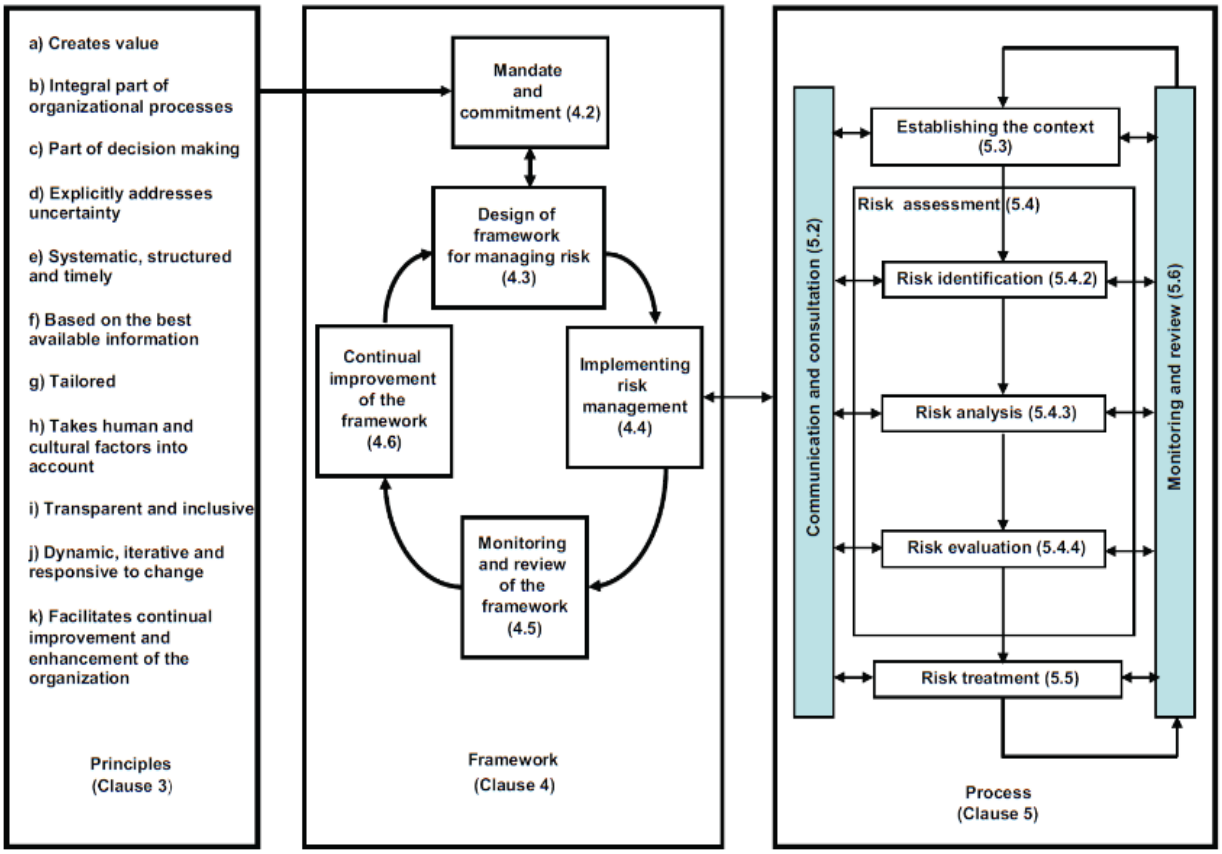
Table 8: Principles of effective risk management

Risk management creates and protects value **Risk management contributes to the demonstrable achievement of objectives and improvement of performance in, for example, human health and safety, security, legal and regulatory compliance, public acceptance, environmental protection, product quality, project management, efficiency in operations, governance and reputation.**
Risk management is an integral part of all organizational processes **Risk management is not a stand-alone activity that is separate from the main activities and processes of the organization. Risk management is part of the responsibilities of management and an integral part of all organizational processes, including strategic planning and all project and change management processes.**
Risk management is part of decision making **Risk management helps decision makers make informed choices, prioritize actions and distinguish among alternative courses of action.**
Risk management explicitly addresses uncertainty **Risk management explicitly takes account of uncertainty, the nature of that uncertainty, and how it can be addressed.**

Risk management is systematic, structured and timely **A systematic, timely and structured approach to risk management contributes to efficiency and to consistent, comparable and reliable results.**
Risk management is based on the best available information **The inputs to the process of managing risk are based on information sources such as historical data, experience, stakeholder feedback, observation, forecasts and expert judgement. However, decision makers should inform themselves of, and should take into account, any limitations of the data or modelling used or the possibility of divergence among experts.**
Risk management is tailored **Risk management is aligned with the organization's external and internal context and risk profile.**
Risk management takes human and cultural factors into account **Risk management recognizes the capabilities, perceptions and intentions of external and internal people that can facilitate or hinder achievement of the organization's objectives.**
Risk management is transparent and inclusive **Appropriate and timely involvement of stakeholders and, in particular, decision makers at all levels of the organization, ensures that risk management remains relevant and up-to-date. Involvement also allows stakeholders to be properly represented and to have their views taken into account in determining risk criteria.**
Risk management is dynamic, iterative and responsive to change **Risk management continually senses and responds to change. As external and internal events occur, context and knowledge change, monitoring and review of risks take place, new risks emerge, some change, and others disappear.**
Risk management facilitates continual improvement of the organization **Organizations should develop and implement strategies to improve their risk management maturity alongside all other aspects of their organization.**

Source: ISO 31000:2009.

Figure 56: Relationship between risk management principles, framework and process

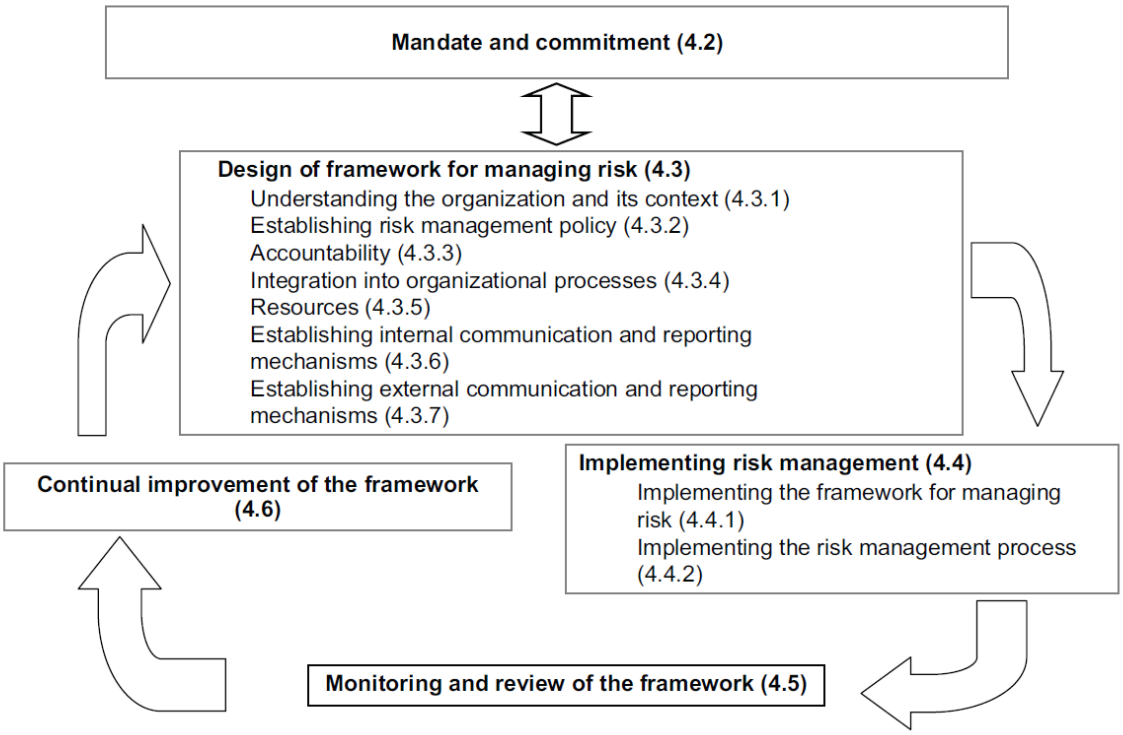


Source: ISO 31000:2009.

The success of risk management will depend on the effectiveness of the management framework providing the foundations and arrangements that will embed it throughout the organization at all levels. The framework assists in managing risks effectively through the application of the risk management process (see Clause 5) at varying levels and within specific contexts of the organization. The framework ensures that information about risk derived from the risk management process is adequately reported and used as a basis for decision making and accountability at all relevant organizational levels.

This clause describes the necessary components of the framework for managing risk and the way in which they interrelate in an iterative manner, as shown in Figure 57.

Figure 57: Relationship between the components of the framework for managing risk



Source: ISO 31000:2009.

This framework is not intended to prescribe a management system, but rather to assist the organization to integrate risk management into its overall management system. Therefore, organizations should adapt the components of the framework to their specific needs.

If an organization's existing management practices and processes include components of risk management or if the organization has already adopted a formal risk management process for particular types of risk or situations, then these should be critically reviewed and assessed against this International Standard, in order to determine their adequacy and effectiveness.

2 Establishing risk management policy

The risk management policy should clearly state the organization's objectives for, and commitment to, risk management and typically addresses the following (ISO 31000, 2009):

the organization's rationale for managing risk
links between the organization's objectives and policies and the risk management policy
accountabilities and responsibilities for managing risk
the way in which conflicting interests are dealt with
commitment to make the necessary resources available to assist those accountable and responsible for managing risk
the way in which risk management performance will be measured and reported
commitment to review and improve the risk management policy and framework periodically and in response to an event or change in circumstances

The risk management policy should be communicated appropriately.

Accountability

The organization should ensure that there is accountability, authority and appropriate competence for managing risk, including implementing and maintaining the risk management process and ensuring the adequacy, effectiveness and efficiency of any controls.

This can be facilitated by (IS0 31000, 2009):

identifying risk owners that have the accountability and authority to manage risks
identifying who is accountable for the development, implementation and maintenance of the framework for managing risk
identifying other responsibilities of people at all levels in the organization for the risk management process
establishing performance measurement and external and/or internal reporting and escalation processes
ensuring appropriate levels of recognition

Integration into organizational processes

Risk management should be embedded in all the organization's practices and processes in a way that it is relevant, effective and efficient. The risk management process should become part of, and not separate from, those organizational processes. In particular, risk management should be embedded into the policy development, business and strategic planning and review, and change management processes.

There should be an organization-wide risk management plan to ensure that the risk management policy is implemented and that risk management is embedded in all of the organization's practices and processes. The risk management plan can be integrated into other organizational plans, such as a strategic plan.

Resources

The organization should allocate appropriate resources for risk management.

Consideration should be given to the following (IS0 31000, 2009):

people, skills, experience and competence
resources needed for each step of the risk management process
the organization's processes, methods and tools to be used for managing risk
documented processes and procedures
information and knowledge management systems
training programmes

2 Implementing risk management

Implementing risk management first includes implementing the framework for managing risks and the risk management process, and secondly it includes risk assessment and risk treatment.

Implementing the framework for managing risk

In implementing the organization's framework for managing risk, the organization should (IS0 31000, 2009):

define the appropriate timing and strategy for implementing the framework
apply the risk management policy and process to the organizational processes
comply with legal and regulatory requirements

ensure that decision making, including the development and setting of objectives, is aligned with the outcomes of risk management processes
hold information and training sessions
communicate and consult with stakeholders to ensure that its risk management framework remains appropriate

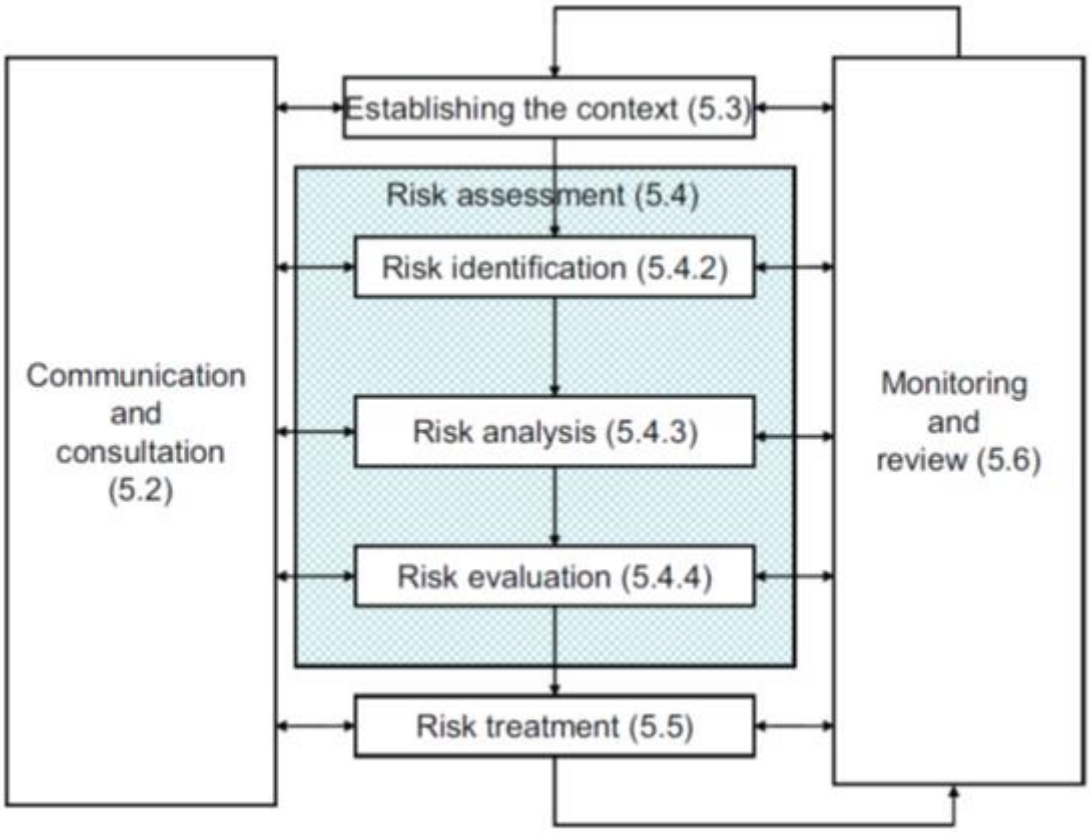
Implementing the risk management process

Risk management should be implemented by ensuring that the risk management process is applied through a risk management plan at all relevant levels and functions of the organization as part of its practices and processes.

The risk management process should be (IS0 31000, 2009):

an integral part of management
embedded in the culture and practices
tailored to the business processes of the organization

Figure 58: Risk management process



Source: ISO 31000:2009.

Risk assessment

Risk assessment is the overall process of risk identification, risk analysis and risk evaluation.

Risk identification

The organization should identify sources of risk, areas of impacts, events (including changes in circumstances) and their causes and their potential consequences. The aim of this step is to generate a comprehensive list of risks based on those events that might create, enhance, prevent, degrade, accelerate or delay the achievement of objectives. It is important to identify the risks associated with not pursuing an opportunity. Comprehensive identification is critical, because a risk that is not identified at this stage will not be included in further analysis.

Identification should include risks whether or not their source is under the control of the organization, even though the risk source or cause may not be evident. Risk identification should include examination of the knock-on effects of particular consequences, including cascade and cumulative effects. It should also consider a wide range of consequences even if the risk source or cause may not be evident. As well as identifying what might happen, it is necessary to consider possible causes and scenarios that show what consequences can occur. All significant causes and consequences should be considered.

The organization should apply risk identification tools and techniques that are suited to its objectives and capabilities, and to the risks faced. Relevant and up-to-date information is important in identifying risks. This should include appropriate background information where possible. People with appropriate knowledge should be involved in identifying risks.

The tool we purpose is risk catalogue, which can be made by the company itself or – no to waste a precious time – you can use Supply chain risk catalogue developed in the Laboratory of Informatics of the Faculty of Logistics UM. If company will identify its risk itself, we recommend the use of simple methods such as surveys, interviews and brainstorming. Since we believe that this whole process is time consuming and often ineffective we created a catalogue of risks in supply chains, which can serve as a support in the initial stages of risk management to both, businesses as well as the wider communities (e.g. countries). The catalogue is freely available to all via the web address ***http://labinf.fl.uni-mb.si/risk-catalog/***. It contains a list of currently known risk, along with their descriptions and definitions, all in accordance with current standards in the field of risk management (ISO 31000, ISO 28000). Thus, individual risks are identified according to their impact, scope, resources, logistics and the like. At the same catalogue allows adjustment of each individual organization or community, as it includes guidelines for the definition of additional risks that are organizationally specific. As a result, completed and adapted catalogue offers exceptional value to the organization or community, not only as review of all threats, but also as an aid for decisions in the field of risk management. The procedure itself, which is tested in practice in logistics companies, is highly customizable and with some minor adjustments can be applied to different environments and combined with different requirements regarding the content and data confidentiality.

Risk analysis

Risk analysis involves developing an understanding of the risk. Risk analysis provides an input to risk evaluation and to decisions on whether risks need to be treated, and on the most appropriate risk treatment strategies and methods. Risk analysis can also provide an input into making decisions where choices must be made and the options involve different types and levels of risk.

Risk analysis involves consideration of the causes and sources of risk, their positive and negative consequences, and the likelihood that those consequences can occur. Factors that affect

consequences and likelihood should be identified. Risk is analysed by determining consequences and their likelihood, and other attributes of the risk. An event can have multiple consequences and can affect multiple objectives. Existing controls and their effectiveness and efficiency should also be taken into account.

The way in which consequences and likelihood are expressed and the way in which they are combined to determine a level of risk should reflect the type of risk, the information available and the purpose for which the risk assessment output is to be used. These should all be consistent with the risk criteria. It is also important to consider the interdependence of different risks and their sources.

The confidence in determination of the level of risk and its sensitivity to preconditions and assumptions should be considered in the analysis, and communicated effectively to decision makers and, as appropriate, other stakeholders. Factors such as divergence of opinion among experts, uncertainty, availability, quality, quantity and ongoing relevance of information, or limitations on modelling should be stated and can be highlighted.

Risk analysis can be undertaken with varying degrees of detail, depending on the risk, the purpose of the analysis, and the information, data and resources available. Analysis can be qualitative, semi-quantitative or quantitative, or a combination of these, depending on the circumstances.

Consequences and their likelihood can be determined by modelling the outcomes of an event or set of events, or by extrapolation from experimental studies or from available data. Consequences can be expressed in terms of tangible and intangible impacts. In some cases, more than one numerical value or descriptor is required to specify consequences and their likelihood for different times, places, groups or situations.

Risk evaluation

The purpose of risk evaluation is to assist in making decisions, based on the outcomes of risk analysis, about which risks need treatment and the priority for treatment implementation.

Risk evaluation involves comparing the level of risk found during the analysis process with risk criteria established when the context was considered. Based on this comparison, the need for treatment can be considered.

Decisions should take account of the wider context of the risk and include consideration of the tolerance of the risks borne by parties other than the organization that benefits from the risk. Decisions should be made in accordance with legal, regulatory and other requirements.

In some circumstances, the risk evaluation can lead to a decision to undertake further analysis. The risk evaluation can also lead to a decision not to treat the risk in any way other than maintaining existing controls. This decision will be influenced by the organization's risk attitude and the risk criteria that have been established.

Risk treatment

Risk treatment involves selecting one or more options for modifying risks, and implementing those options. Once implemented, treatments provide or modify the controls.

Risk treatment involves a cyclical process of assessing a risk treatment; deciding whether residual risk levels are tolerable; if not tolerable, generating a new risk treatment; and assessing the effectiveness of that treatment.

Risk treatment options are not necessarily mutually exclusive or appropriate in all circumstances. The options can include the following (IS0 31000, 2009):

avoiding the risk by deciding not to start or continue with the activity that gives rise to the risk
taking or increasing the risk in order to pursue an opportunity
removing the risk source
changing the likelihood
changing the consequences
sharing the risk with another party or parties (including contracts and risk financing)
retaining the risk by informed decision

Selection of risk treatment options

Selecting the most appropriate risk treatment option involves balancing the costs and efforts of implementation against the benefits derived, with regard to legal, regulatory, and other requirements such as social responsibility and the protection of the natural environment. Decisions should also take into account risks which can warrant risk treatment that is not justifiable on economic grounds, e.g. severe (high negative consequence) but rare (low likelihood) risks.

A number of treatment options can be considered and applied either individually or in combination. The organization can normally benefit from the adoption of a combination of treatment options.

When selecting risk treatment options, the organization should consider the values and perceptions of stakeholders and the most appropriate ways to communicate with them. Where risk treatment options can impact on risk elsewhere in the organization or with stakeholders, these should be involved in the decision.

Though equally effective, some risk treatments can be more acceptable to some stakeholders than to others.

The treatment plan should clearly identify the priority order in which individual risk treatments should be implemented.

Risk treatment itself can introduce risks. A significant risk can be the failure or ineffectiveness of the risk treatment measures. Monitoring needs to be an integral part of the risk treatment plan to give assurance that the measures remain effective.

Risk treatment can also introduce secondary risks that need to be assessed, treated, monitored and reviewed.

These secondary risks should be incorporated into the same treatment plan as the original risk and not treated as a new risk. The link between the two risks should be identified and maintained.

CASE STUDIES

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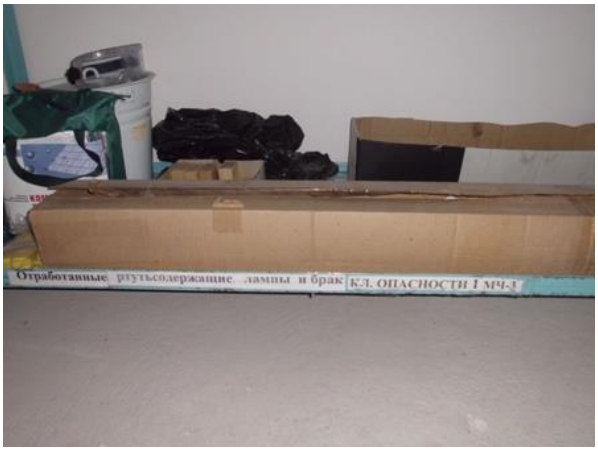
1 Simple photo cases

Imagine, you are an environmental auditor of mechanical division of handling operations and commercial transactions – the subsidiary of JSC “Russian Railways”.

1. According to photos, give a comment on photo content from random testing locations.
2. What are the regulations of accumulation and temporary waste storage?
3. Recommend how to remedy breaches.

Case 1

Mercury-containing, luminescent lamps:



Case 2

<u>Ungraded ferrous scrap</u>

Case 3

<u>Oil-contaminated sand</u>

Case 4

<u>Oil-contaminated sorbents</u>

Case 5

<u>Rubbish from welfare spaces, except of bulk waste; industrial zone sweepings</u>

Case 6

<u>Automobile scrap tires</u>

Case 7

<u>Wooden containers, which have lost their consumer attributes</u>

Case 8

<u>Waste lead batteries with acid</u>

Case 9

<u>Used transmission gear engine oils</u>

Case 10

Used greased filters

Case 11

Rubbish from welfare spaces, except of bulk waste; selective waste accumulation

Case 12

<u>Steel welding electrodes remains and stubs</u>

Case 13

<u>Oily rags (oil content is under 15%)</u>

Case 14

<u>Abrasive fly ash, used abrasive disks</u>

2 Legal bases of environmental management in system of ecological management – case tasks

Task 1

Before works on laying of communications the fertile layer of earth has been removed from the land plot. According to the project of recultivation the fertile layer of earth was subject to warehousing and the subsequent drawing on the territory which is subject to recultivation. During transportation of a fertile layer of earth the considerable part it is damaged as a result of contact with chemicals. Specially authorized body in the field of protection of lands has attracted the organization which is carrying out transportation of a fertile layer of earth to the administrative responsibility provided by the Land code of the Russian Federation concerning damage of a fertile layer of earth.

1. Whether the removed fertile layer of earth is object of the ecological right?
2. Whether legally specially authorized body in the area of protection of lands has brought the organization which was carrying out transportation of a fertile layer of earth to administrative responsibility?

Task 2

The legislative assembly N areas has directed to the conclusion to the expert the bill of the "About Protection of Environment" area. The expert has specified the following in the conclusion:

- according to Art. 72 of the Constitution of the Russian Federation the legislation on environmental protection belongs to joint maintaining Federation and territorial subjects of the federation
- proceeding from sense of the p. 2 of Art. 76 of the Constitution of the Russian Federation the law of the territorial subject of the federation in a subject of joint maintaining has to be accepted in a sootvetkstviye with the federal law.

1. Give a legal treatment to the expert's position.
2. Give interpretation of standards of Art. 76 of the Constitution of the Russian Federation in relation to the legislation on protection of surrounding environment.
3. Make the conclusion on a ratio of the federal laws and other legal acts issued in the Russian Federation the normaktivnykh governing the relations in the field of environmental protection.

Task 3

The citizen Kryuchkov has appealed to the assistant prosecutor of the area to explain him an acquisition order in property of the land plot for maintaining a farm.

1. As the assistant prosecutor of the area explain to the citizen Kryuchkov the acquisition order established by the legislation of Russia in a private property of the land plot.

Task 4

According to the solution of a representative body of Belovsky district all natural objects and resources in borders of municipality are declared by a sole property of this education.

1. Estimate legality of the decision of this body.

Task 5

The citizen Orlov has got in a private property behind the line of settlements a ground intended for farming for the purpose of the poultry farm device. On a site wild-growing forest trees and bushes which Orlov has cut down as they prevented target use of the earth grew. From forestry the claim for collecting from Orlov of cost of illegally cut down plants has been made.

1. Whether actions of forestry are lawful?
2. Whether the wood and shrubby vegetation on Orlov's site enters into forest fund Russian Federation?

Task 6

In territorial waters of Norway in view of wear of the petrotransporting tanker with the displacement more than 2000 t., belonging on the property rights to the captain - to the citizen of Latvia, there was an emergency leak of oil. The vessel hasn't been insured and had no other financial security.

1. What international treaty establishes responsibility for oil spill?
2. What limit of responsibility set by this contract?
3. Who in this case is responsible for the damage caused by oil leak?

Task 7

Having gone to the country in the forest zone carried to the woods of the first group, the student Karpov has cut down subgrowth of a fir-tree, in number of 25 pieces, for the purpose of further sale of trees before New year. The amount of damage has made 8000 rub.

1. To properly qualify Karpov's actions?
2. Whether the type of responsibility will change if it is established that the damage caused to them has made over 10 thousand rubles?

Task 8

The worker of forest protection has detained the driver of garment factory Zhirnov during unloading by him from the car of household garbage in forest conservation to a zone. Upon an offense the statement has been drawn up. As it has become clear, the director of factory Sklyarov and the chief technologist Blochin knew about placement of industrial and household garbage (waste) in unspecified places. The similar facts took place and earlier.

1. Explain which of the called persons and to what responsibility can be attracted in connection with commission of this offense?

Task 9

Because of accident on ensky of JSC Khimprom there was a dumping of phenol into the river. Within a week about 150 thousand residents used the water poisoned with phenol, then harm has been done to their health. For the benefit of the city and citizens the prosecutor has made the claim in court to JSC Khimprom.

1. Answer whether are has the right to collect court from the called enterprise a penalty in favor of citizens on account of the indemnification caused to their health?

Task 10

At the enterprise there was an emergency emission of the polluting substances. The citizens living near the enterprise have addressed his administration with the requirement about compensation of the damage caused by the specified emission (pollution of garden and garden cultures during their blossoming and sharp decrease in productivity on the polluted sites). Citizens have shown the corresponding references confirming compensation of damage, issued by local governments. The management of the enterprise has refused compensation of the caused damage, referring to the fact that according to the Law "About Environmental Protection", the enterprise regularly makes payments for emissions and dumpings of the polluting substances, and also has mastered considerable funds for nature protection actions (in particular, treatment facilities on pollution sources are modernized).

1. Give an assessment to legitimacy of requirements of citizens to administration of the enterprise and validity of her answer.

Task 11

Citizens have appealed to regional court with the claim for recognition of the invalid license granted to chemical plant on use of a subsoil for deep burial of radioactive waste. The claim by court it has been refused on those bases that the current legislation of obligatory carrying out the state

environmental assessment at issue of the mentioned license doesn't provide. Citizens have addressed to Judicial board on civil cases of the Supreme Court of the Russian Federation with the complaint.

1. What, in your opinion, there has to be a decision of board of the Supreme Court of the Russian Federation?

Task 12

In one of the region of the Far North the regional fishery inspectorate has found a large oil slick on a reservoir surface. Check has shown that it was formed as a result of a leak of one of tanks of a warehouse of fuels and lubricants. The territorial committee on natural resources has made the claim for indemnification, caused to surrounding environment. The defendant of the claim didn't recognize, referring to the fact that the technology of storage of fuel wasn't broken. The examination appointed by arbitration court has established that the leak in the tank has arisen owing to unfitness of material of which it has been made, for operation in the conditions of Far North. However, tanks have been made and installed in a warehouse according to the project.

1. What other measures provided by the law bodies of the state environmental control can take?

Task 13

The nature protection prosecutor has appealed to district court with the statement for the benefit of the citizen Sidorova for granting to her by iron and steel works of data on a state of environment. Filing of application has been caused by the fact that the citizen Sidorova's request for granting by her by combine of data on the sizes and nature of emissions of the polluting substances hasn't been satisfied with administration of the enterprise. The court of the first instance has refused allowance of the application of the prosecutor, referring to the fact that the combine uses data on the level of pollution of atmospheric air in the production purposes, and also sends them to government bodies to which the duty of providing ecological information to citizens is assigned. In justification of the decision it is made a reference to Art. 24 of the Constitution of the Russian Federation.

After that the nature protection prosecutor and the citizen have sent the appeal to regional court, motivating the disagreement with the decision of district court the fact that according to Art. 8 of the

Law "About Sanitary and Epidemiologic Wellbeing of the Population", citizens have the right to obtain information on a sanitary and epidemiologic situation and a condition of habitat at legal entities.

1. What, in your opinion, there has to be a decision of board of regional court?
2. Prove the answer.

Task 14

To the Kostroma interdistrict nature protection prosecutor the chairman of the regional social ecological movement has addressed because the head of committee on environmental protection of area has refused to provide him the ecological information necessary in connection with performance of public work. He motivated the refusal in providing information with the fact that the specified information is intended for office use.

The nature protection prosecutor has filed a petition in Leninsky district court of Kostroma for the benefit of the public ecological movement to committee on environmental protection of area.

1. Whether refusal of the chairman of committee on environmental protection in providing information on environment is lawful? Solve business.

Task 15

1. How would you carry out the incident investigation and its localization in case you are the head of the HSE service at the oil and gas field in the case of emergency oil spill?
2. What action would you take for prevention of such emergencies in the future?

Task 16

Barrels filled with fuel oil (10 pcs) have been left in the city of X in the territory of the former industrial enterprise during its elimination. Barrels have been placed in a disposal pit and dug. With time near the territory of the former plant houses have been constructed (100 m far from underground disposal).

1. Under the influence of corrosion processes the barrels began to be damaged and fuel oil with rain and storm drains began to come out and to proceed along the territory of houses.
2. Offer technology for neutralization of oil-contaminated soil.

Task 17

Associated oil gas in considered to be valuable chemical raw materials and highly effective organic fuel. For prevention of air pollution by emissions of harmful substances the Government of the Russian Federation has established in 2009 a target indicator of combustion of APG of no more than 5% of the extracted gas volume. Thus the level of use of associated oil gas has to be not less than 95%. The oil-extracting enterprises at oil production use associated petroleum gas for own needs of the enterprise for 60-70%.

1. Make offers on bringing to the use of APG for 95%.

Task 18

Being ecologically focused director in conditions when there is an economic recession what resource-saving events you would hold at the enterprise.

1. Consider consumption of resources, impact of the enterprise on air, water, the soil.

Task 19

Director of one-storey retail shop with an area of 300 m^2 has decided to install panels in order to provide his small enterprise with electric power. Photocells are to be placed on the horizontal roof.

Requirements for lighting the shop are 100 watts per square meter of the ceiling area. Average annual solar power in the city (per unit area) is 150 W/m^2, silicon solar cell efficiency coefficient is 15 per cent, batter charge-and-discharge efficiency coefficient is 80 per cent.

1. Estimate what part of the roof will be occupied with the batteries, assuming that the roof area is equal to the ceiling area?

Task 20

Assume that in the open area, average power of incoming solar radiation during the eight-hour day equals to 700 W/m^2. The heliostats efficiency is 80 per cent. (Heliostat is a device able to rotate the mirror in the direction of the Sun. Heliostats are able to form mirror fields collecting sunlight – so called solar thermal power plants.)

Assume that silicon solar battery on the heliostats converts solar energy into the electric energy with efficiency coefficient equal to 35 per cent.

1. Determine total area of the heliostats creating – in the given conditions – electric power of 10MW.
2. Calculate the area required to place a solar thermal power plant with the electric power of 10 MW, taking into account that the land area under the mirrors should be twice two time larger than the area of the heliostats mirrors.

3 Case studies: Pollution

Case study 1: "Consequences of pollution"

Background

There was an emergency situation with the rolling stock, resulting in overturned several tanks with oily components.

Problem/Description of the case

There was pollution of the territory, the area of 100x50 meters. Two authorized companies offered their services to eliminate the environmental impact.

Calculation of damages is made according to the method of calculating the damages caused to the soil as the object of environmental protection, approved by order of the Ministry of Natural Resources and Ecology of the Russian Federation of 08.07.2010 No 238.

Calculation of damage extent caused to the soil as the object of environmental protection in value form is made according to the formula:

УЩ = УЩзагр + УЩотх + УЩпорч

Where:

УЩзагр - extent of damage caused by chemical pollution of soils (rub.);

УЩотх - extent of damage as a result of unauthorized placement of production and consumption waste, (rub.);

УЩпорч - extent of damage when the soil damage is the a result of unauthorized (illegal) overlapping the soil surface and the soil profile with artificial surfaces (or) linear objects (rub.).

1. Calculation of the chemical contamination of soil in value form is made according to the following formula:

УЩзагр = СХВ x S x Kr x Кисх x Тх

Where:

СХВ - the degree of chemical pollution accepted equal to 6;

S - polluted land area (sq. M) m.

Kr - indicator, depending on the depth of chemical pollution or deterioration of soils = 1.5 (average pollution of soil depth of 60 cm);

Кисх - indicator, depending on the land category and its target purpose where the polluted area is located= 1 (land transport - railway right of way);

Тх - fee for calculation the damage extent to the soil as environmental protection object caused by chemical pollution = 500 rubles / sq. M. M (forest-steppe zone - meadow black soils).

2. Calculation of the extent of damage to the soil as a result of unauthorized (illegal) overlapping the soil surface and soil profile with artificial surfaces and (or) the linear objects is carried out according to the formula:

УЩпорч = S x Kr x Кисх x Тх

A sample of the defective act and a price list of works are included.

The missing data is to be taken from public sources.

<u>Aims</u>

1. To determine the total area and volume of pollution.
2. To calculate the damage caused to the environment as a result of oil pollution of land.

3. What measures should be taken to prevent further possible claims from Rosprirodnadzor or local administration?
4. To make a chart, defective act, define the scope of work.
5. To determine the cost of services of the two companies. Explain the choice of the company. Evaluate the economic impact of the carried out activities.

Case study 2: "Soil treatment"

Background

Biochemical processes of oxidation by microorganisms are used to purify soil from oil pollution.

Problem/Description of the case

There are more than 100 kinds of bacteria, yeast and fungi, using oil hydrocarbons as power sources. Various hydrocarbon biodegradation processes proceed at different rates depending on both the type of microorganism, and the nature of the hydrocarbon. Aliphatic hydrocarbons are most appropriate for microbial decomposition, whereas cyclic and aromatic compounds are more difficult to destroy. Hydrocarbon biodegradation products are CO2, H2O and other environmentally neutral materials.

A number of bacterial agents have been developed in Russia. They are successfully applied for the purification of soil from oil pollution. Among them are "Putidoil", "Oleovorin", "Devoroil", "Soilex", "Ruden" and others.

The tables show the results of the use of "Putidoil" and "Oleovorin".

Table 9: Results of laboratory tests on soil samples on soil purification from oil products (OP) by biologic agent "Putidoil"

Test specimen	Basic amount of OP, g/kg	In 1 month		In 2 months		In 3 months	
		OP, g/kg	Purification rate, %	OP, g/kg	Purification rate, %	OP, g/kg	Purification rate, %
1. Locomotive depot 1	134	105	22	103	23,1	72	46
2. The same without agent treatment	134	133	0,7	-	-	133	0,7

3. Locomotive depot 2	58	43,7	25	33	43	32	45
4. The same without agent treatment	58	57,5	0,9	-	-	56	3,1
5. Ballast of the railway section	21,8	10,4	53	-	-	9,0 (6 month)	59
6. The same without agent treatment	21,8	21,8	-	21,8	-		

Table 10: Results of laboratory tests on soil samples on soil purification from oil products (OP) by biologic agent “Olevarin”

Test specimen	Basic amount of OP, g/kg	In 1 month		In 2 months		In 3 months	
		OP, g/kg	Purification rate, %	OP, g/kg	Purification rate, %	OP, g/kg	Purification rate, %
1. Locomotive depot 1	73	34	53,4	25	65,8	17	77
2. The same without agent treatment	73	73	-	-	-	71,5	2,1
3. Locomotive depot 2	143	115	19,6	67	53,2	32	77,6
4. The same without agent treatment	143	143	-	-	-	138	3,5
5. Ballast of the railway section	113	92	18,6	88	22,1	85	24,8
6. The same without agent treatment	113	113	-	-	-	113	-

Aims

1. To analyze the efficiency of the use of agents “Oleovarin” and “Putidoil” according to the results of laboratory tests on soil purification from oil products.
2. Make recommendations on their use in railway transport.
3. What are other methods of purifying soil from oil products, and what are their advantages and disadvantages?

Case study 3: “Inspection results”

Background

State authorities for environmental supervision carried out an inspection of treatment facilities of the company N.

Problem/Description of the case

The inspection revealed that the company N was periodically discharging untreated water into the river although it has modern treatment facilities. Discharges were made at night, bypassing treatment facilities. This was done according to administration’s instructions in order to save funds on electricity and reagents.

Aims

1. Assess the situation in the company from the point of view of environmental protection legislation.
2. What should be the reaction of the company employee upon receipt of such instruction from the administration?
3. What kinds of liability for environmental offenses are there, and what legal punishment awaits the company administration?

Case study 4: “Oil spill”

Background

An oil spill was found on the water surface of the river K, 10 km downstream from the petrochemical plant N, and 3 km from the floating oil plant S.

Problem/Description of the case

An unmanned aerial vehicle allowed to define the oil slick area - 100 sq.m; the rate of river flow is 0.5 m/s; the distance to the nearest water intake is 25 km. There is fish death in the area of the slick.

Aims

1. Assess the situation from the point of view of the danger to the river ecosystem and water intake.
2. What measures should be taken by the managements of the company N and the floating oil plant S?

Case study 5: "Oil pollution"

Background

Oil lenticles were found on the area of 1.5 hectares at one of the railway' enterprises, adjacent to the fuel storage near a rural settlement.

Problem/Description of the case

Underground oil manmade lenticles amount to 3000 square meters. The volume of underground contaminated soil is 1250 cubic m; the volume of oil in the free phase is 50 cubic meters.

The case is complicated by the location of the territory close to residential areas and a complex relief – a ravine with a natural flow along the thalweg into the river, the river is 1.5 km. away.

Aims

1. Assess the situation from the point of view of the danger for the residents of the village and the river ecosystem.
2. Take urgent measures on localization and elimination of oil product contamination upon its discovery on the soil surface.

4 Case studies in teams

Case study 1: "Environmental legislation of Russian Federation"

Conducting case study

Each participating team obtains background information on results of verification of environmental legislation requirements fulfilment and 3 subtasks representing single choice tests.

- The students are allowed to use open source information including Web resources.
- The first team that submits the right answers (including subtasks) to the jury wins.

In autumn 2011 patrol inspection conducted by the Russian Federal Agency for Oversight of Natural Resource Usage department for the Central Federal District revealed an unauthorized dumping ground in Morshchikhino village, part of Khimki Urban Okrug. 28.11.2011 Administration of Khimki Urban Okrug was held administratively liable for this breach of law by the Russian Federal Agency for Oversight of Natural Resource Usage department for the Central Federal District, according to the Article 8.2 of Russian Federation Administrative Offense Code, and was penalized in the amount of 200000 rubles.

Subtask 1

Cases of imposing administrative liability are resolved by the _____ court.
Options:

a) arbitration;
b) referee's;
c) magistrates';
d) district.

Subtask 2

Russian Federal Agency for Oversight of Natural Resource Usage is authorized to fulfil the following tasks _____ .

Options:

a) environmental standardization;
b) protection of water bodies;
c) carrying out State Environmental Expertise;
d) water bodies monitoring.

Subtask 3

Administrative liability for the environmental offence is expressed in application of the penal _____ to the offender.

Options:

a) Charge
b) Sanctions
c) Actions

Case study 2: "Analysis and enhancement of environmental efficiency in industry"

Conducting case study

After self-studying ISO 14040 standard each team defines life cycle of any product as well as qualitative assessment of its impact on environment on every stage of its life cycle.

(must be presented in Power Point)

The jury may conduct random drawing of lots – giving names of the 4 products to be analyzed in the sealed envelopes to the teams, e.g.:

1. Passenger compartment carriage,
2. School textbook, hardback, with full-color illustrations,
3. Pack of cookies "Yubileynoe", weight 200 g.,
4. Bag of engine oil for the car, vol. 5 l.

- The students are allowed to use open source information including Web resources.
- Developed life cycles of the products are presented at the joint seminar.

The winning team is defined by the jury according to the results of the presentations and the subsequent joint inter-team discussion.

***Case study 3: "*Environmental policy"**

Conducting case study

Each team carries out a task: «Development of environmental policy of the enterprise».

(must be presented in Power Point).

The jury conducts random drawing of lots - giving names of the 4 enterprises to be analyzed in the sealed envelopes to the teams, e.g.:

1. Passenger railroad car depot – structural subdivision of Federal Passenger Company – branch of JSC "Russian Railways",
2. Oil-refining plant,
3. Regional signal operations center - structural subdivision of West-Siberian administration of signal operations – branch of JSC "Russian Railways,
4. LLC Building & Construction Department for industrial objects construction.

- The students are allowed to use open source information including Web resources.
- Developed environmental policies of the enterprises are presented at the joint seminar.

The winning team is defined by the jury according to the results of the presentations and the subsequent joint inter-team discussion.

Case study 4: "Environmental goals and objectives"

Conducting case study

Each team carries out a task: «Defining environmental goals and objectives of the enterprise».

(must be presented in Power Point).

The jury conducts random drawing of lots - giving names of the 4 enterprises to be analyzed in the sealed envelopes to the teams, e.g.:

1. Locomotive repair depot – structural subdivision of JSC "Russian Railways",

2. Oil-production enterprise,
3. Data-processing center – structural subdivision of Information Technology Department – branch of JSC "Russian Railways",
4. Housing-construction plant (housing construction).

- The students are allowed to use open source information including Web resources.
- Developed variants of environmental goals and objectives are presented at the joint seminar.

The winning team is defined by the jury according to the results of the presentations and the subsequent joint inter-team discussion.

Case study 5: "Environmental protection measures"

<u>Conducting case study</u>

Each team carries out a task: «Development of yearly plan of environmental protection measures».

(must be presented in Power Point).

The jury conducts random drawing of lots - giving names of the 4 enterprises to be analyzed in the sealed envelopes to the teams, e.g.:

1. Railway station N – structural subdivision of regional Administration of Railway Stations – branch of JSC "Russian Railways",
2. Gas pipelines construction plant» in The Far North and Siberia,
3. Central Heating and Power Plant №5, Omsk – structural subdivision of JSC «Territorial generating company TGC-11,
4. Confectionery factory.

- The students are allowed to use open source information including Web resources.
- Developed variants of yearly plans of environmental protection measures are presented at the joint seminar.

The winning team is defined by the jury according to the results of the presentations and the subsequent joint inter-team discussion.

Case study 6: "Environmental management system (EMS)"

Conducting case study

Each team carries out a task: «Find out and justify three most significant reasons for the implementation of the environmental management system at the enterprise».

(must be presented in Power Point).

- The students are allowed to use open source information including Web resources.
- Findings and arguments developed by the teams are presented and discussed, the final version of «3 reasons for EMS implementation» is elaborated.

The winning team is defined by the jury according to the results of the presentations and the subsequent joint inter-team discussion

5 Case studies: Environmental priorities of an enterprise

Case study 1 "Complaints on the noise"

Background

There were complaints from the inhabitants of the village R about the noise from rail transport and an appeal from the administration of the village about installation of noise screens along the railways.

Problem/Description of the case

Some inhabitants live in 10 houses that are located at a distance less than 100 m from the outer rail. Other houses are located at a distance beyond 100 m from the outer rail. There is also a federal highway along the village. Installation of noise screens is carried out on the basis of the calculations

when designing new construction projects and it is very costly, average price of noise screens is 157 thousand. rub per meter.

The missing data is to be taken from public sources, Internet.

Aims

1. to find out the source of the problem
2. -to solve the problem

Case study 2: "Environmental priorities of the company"

Background

The company is operating in the context of economic recession and has to save on budget expenditures.

Problem/ Description of the case

The company is run by an environmentally oriented director who is aware that there may be economic sanctions for breaches of environmental legislation. He understands that it is necessary to keep records of resource consumption, the impact of the enterprise on the air, water and soil. The missing data must be taken from open sources.

Aims

1. What resource saving measures do you consider appropriate for the company located in your area?
2. Set short, medium, long-term priorities of the environmental policy of the company.

Case study 3: "Pollution control facilities"

Background

The enterprise was put up a big bill for excessive pollution discharged into the municipal wastewater system.

Problem/Description of the case

Release of treated industrial waste water goes into the city collector of water communal facilities. There is a flotation unit intended for the treatment of industrial waste water from oil pollution and oil residues. The unit has two flotation plants with the capacity of 20 m3 / h and an oil trap (sump). Sumps (oil trap) are used as the first stage of treatment facilities for the removal of bulk suspended solids and oil products from the wastewater. The missing data is to be taken from public sources.

Aims

1. What measures are to be taken to prevent further excessive payments?
2. Evaluate the operation of pollution control facilities.
3. Consider the technology of sewage treatment plants and determine the causes of poor cleaning (low efficiency of the flotation unit or other reasons).
4. Create a water balance scheme of the enterprise.

Case study 4: "Nitrates and Staff health"

Background

Enterprise N, guided by the idea of ecological and economic expediency, decided to revive subsistence farming and grow vegetables for the staff including melons and gourds.

Problem/Description of the case

Nitrates (salts of nitric acid - NaNO3, KNO3, NH4NO3, Mg (NO3) 2) in plants are natural and necessary for biomass synthesis. So there aren't any fully nitrate free fruits and vegetables. The amount of nitrate varies depending on the stage of ripening and technologies of crop growing. Nitrates can be irregularly distributed in different parts of fruits and vegetables. We also know that the main danger to human health is associated with nitrate transformation into more toxic nitrites and nitrosamines. 200-300 mg of nitrates per day is considered safe for a human being (with an average weight of 70 kg), whereas 600-700 mg may cause toxic poisoning. The content of nitrates is regulated by the indicator of MPC (maximum permissible concentration). (MPC for nitrates is 60 mg / kg for watermelon and 90 mg / kg – for melons).

People consume about 70% of nitrates with fruits and vegetables, the remaining amount – with drinking water (20%), canned meats and sausages, and from other sources (about 10%). The amount

of nitrates can be substantially reduced through pre-processing of fruits and vegetables (washing, cleaning, soaking, boiling, etc.).

Aims

1. What can increase amounts of nitrates in food products result in for an enterprise employee?
2. Why is melon poisoning so frequent?
3. The analysis of produce before harvest revealed excess of MPC of nitrates in carrots by 40%. What should be done?

Case study 5: "Food stuff quality"

Background

The canteen of the company N bought frozen sea fish. The head of the company decided to check the quality of the fish as he is aware that this food staff may contain elevated levels of heavy metals due to pollution of the hydrosphere.

Problem/Description of the case

Of the total amount of mercury that a person gets from food, about half is with animal products and one-third - with plant food. Annually 9000 tons of mercury are produced in the world, of which 5,000 tons are later found in the oceans.

An authorized laboratory for checking food quality obtained the following results on the content of heavy metals per 100 g of sample: Food - Frozen sea fish, Pb - 0,04; Cd - 0,002; Hg - 0,11; Cu - 0,65; Zn - 3,2. MPC in fish (mg / kg): Pb - 1; Cd - 0,02; Hg - 0,4; Cu - 10; Zn - 40.

Aims

1. Describe the presence of heavy metals in terms of edibility using the information on the MPC in fish.
2. Why are there different MPC values for different food stuffs?
3. What is the danger of heavy metals like toxicants?

6 Case studies: Company concern in environmental management

Case study 1: "Water release"

Background

The Federal Agency for Water Resources of the Ministry of Natural Resources set higher rates for waterworks facilities. The decision was based on recommendation of the Interagency Task Force about the operating mode of reservoirs of the Volga-Kama cascade during spring floods.

Problem/Description of the case

This decision suited all the departments concerned. However, increased water releases through waterworks facilities threatened smooth operation of the river oil terminal of the railway station. Further information on the case is to be taken on your own.

Aims

1. What operational measures must be taken to prevent railroad accidents?
2. To develop an action plan to prevent similar incidents.

Case study 2: "Reserve areas"

Background

A businessperson N decided to place a retail outlet on the border of the reserve area**.**

Problem/Description of the case

In order to place this outlet, the businessman decided to cut 4 trees. This fact was recorded by a dashboard camera of the reserve employee's car. Further information on the case is to be taken on your own.

Aims

1. How to determine the criminal character of the businessman's act?
2. What measures should the employee of the reserve take?
3. What kinds of liability for environmental offenses are there, and what legal punishment awaits the businessman?

Case study 3: "Rational use of land resources"

Background

Scientists are concerned about the state of land resources in Russia today.

Problem/Description of the case

Agricultural lands in Russia amount to only 222.1 million hectares, including arable land - 132.2 million hectares. Of these, about 124 million hectares (including 82.5 million hectares of arable land) are subjected to erosion and deflation (blowing), 26 - waterlogged, 73 - acid, 40 - alkalized and alkalinized, 62 – industrially polluted, including 5 - radiation polluted, 9- over deserted, 3 - overgrown with shrubs and low forests, 2.3 million hectares need restoration.

Land disturbance is caused by open and underground mining, storage of industrial, construction and municipal waste, construction of line structures (including railway ones), as well as exploration, survey, construction and other works. Moreover, as a rule disturbed soil cover change hydrogeological and hydrological modes, form a man-made relief. There are also other qualitative changes which adversely affect the environment as a whole.

For a pipeline a company N needs to dig a trench 500 m in length, 2,5m deep and 1.2 m wide.

Aims

1. To identify nature aligned actions on the part of the operator of the earthworks.
2. What are soil functions in ecosystems? Why are fertile lands considered conditionally renewable resources?
3. What is the restoration of disturbed lands? Justify the selected option of restoration.

Case study 4: "Waste treatment"

Background

There is hazardous waste in the structural division of JSC "Russian Railways"; its treatment is strictly regulated.

Problem/Description of the case

Having studied the waste treatment log, calculations of payments for negative impact on the environment in the given year, statistic report according to the form №2-tp (wastes), inspectors found out that the company N produced such types of hazardous waste as remains of diesel fuel, that lost its consumer properties, diesel oil waste, sawdust contaminated with oils, which according to the Federal inventory of the waste classification, approved by the Ministry of natural resources of the Russian Federation of 02.12.2002 number 786, refer to 3rd class of danger.

However, in violation of Part 3 of Article 14 of the Federal Law "On production and consumption waste" at the time of inspection, the passports of the above mentioned hazardous wastes have not been approved by "Rosprirodnadzor" (Federal Service for supervision of natural resource usage) and storage areas have not been determined.

Aims

1. Assess the situation in the company from the point of view of environmental protection legislation.
2. What kinds of liability for environmental offenses are there, and what legal punishment awaits the company administration?

Case study 5: "Government support"

Background

Since 2015 Russia has established government support for the activities aimed at environmental protection.

Problem / Description of the case

Ways of support:

- Investing into implementation of the best available technologies and other measures to reduce the negative impact;
- Environmental education and information support of activities aimed at mitigation of environmental effects;

- The use of renewable energy resources, recycled resources.

Aims

1. How can a company receive government support for environmental protection?

7 Complex case studies

Case study 1

The emergency situation occurred on the mail oil pipeline. The polluted area is estimated to be 500x300 m. Two companies with the proper licenses have offered their services to liquidate the accident consequences. Define total accident area and its amount. Calculate the damage done to the environment as a result of pollution. What actions should be taken to prevent future claims from the Russian Federal Service for Surveillance on Consumer Rights Protection and Human Wellbeing (Rospotrebnadzor) and the local Administration? Define the scheme, the act of defective, and define the amount of work. Determine the cost of the work of the two companies. Justify the choice in term of the companies. Determine the economic effect from the activities implemented.

The damage calculation is carried out by the Method of calculation the damages done to the soils as the environmental protection object approved by the decree №238 of Ministry of Natural Resources and Environment of Russian Federation from 08.07.2010.

Calculation of value in the form of the size of damage caused to the soil as the object of environmental protection is carried out according to the formula:

$$\mathbf{У = У_{загр} + У_{отх} + У_{порч}}$$

Where:

$\mathbf{У_{загр}}$ –damage size caused by chemical pollution (rubles);

$\mathbf{У_{отх}}$ – damage size in the result of unauthorized размер вреда в результате несанкционированного placement of products of production and consumption waste (roubles);

$\mathbf{У_{порч}}$ – damage sized caused by unauthorized (illegal) soil cover or/and the soil profile by the artificial covers and/or line objects (roubles);

Economical estimation of the damage size from the soils and lands degradation is determined by the formulae:

$$\text{У}_{\text{прд}}^{\text{П}} = \text{Н}_{\text{с}}\ \text{S}\ \text{К}_{\text{э}}\ \text{К}_{\text{П}},$$

Where:

$\text{У}_{\text{прд}}^{\text{П}}$ – value of the avoided damage in the result of environmental activities at the observed territory during defined period of time, thousands of rubles per ha. (127 rubles/ha.);

S – the soils and lands area saved from degradation during the defined period of time in the result of environmental activities, ha.;

$\text{К}_{\text{э}}$ – coefficient of ecological situation and ecological significance of the territory (1,2);

$\text{К}_{\text{П}}$ – coefficient for especially protected areas (3).

Lacked data should be taken form the open information sources.

Case study 2

Calculate amount of payments for air pollution caused by the sources situated on the oil field. The oilfield is situated in the Tyumen oblast'. Emissions data are in the Table 1. The actual masses of emission values math maximum permissible emissions.

Table 11: Data on air pollution sources

Sources of pollutant emissions		*Name of the Sources of pollutant emissions*	*Substance*	*Emission mass, t/year*
Name	*Number*			
Oil pipeline: valves assembles	*2*	*Unorganized sources: looseness of flanges and fittings*	*Mixture of hydrocarbons C_1-C_5*	*0,1214*
			Benzene	*0,00059*
			Toluene	*0,00037*

			Xylol	*0,00018*
			Hydrogen sulfide	*0,0001*
			Total	*0,127*
Booster pump station: crude oil storage tank PBC-2000	*1*	*Breathing valve*	*Mixture of hydrocarbons C_1-C_5*	*58,6*
			Benzene	*0,283*
			Toluene	*0,178*
			Xylol	*0,0891*
			Hydrogen sulfide	*0,0486*
			Total	*80,9*
Насосы внешнего транспорта нефти	*1*	*Seals, valves, flanged connections*	*Mixture of hydrocarbons C_1-C_5*	*0,25044*
			Benzene	*0,00121*
			Toluene	*0,00076*
			Xylol	*$3,8 \bullet 10^{-4}$*
			Hydrogen sulfide	*0,00021*
			Total	*0,26825*
Oil metering	*1*	*Valves, flanged connections*	*Mixture of hydrocarbons C_1-C_5*	*0,21349*
			Benzene	*10^{-3}*
			Toluene	*$7 \bullet 10^{-4}$*
			Xylol	*$3 \bullet 10^{-4}$*
			Hydrogen sulfide	*$1,8 \bullet 10^{-4}$*
			Total	*0,220*

Case study 3

The oil spill occurred at the oil refining facilities. The volume of oil spilled is 1.4 t. Calculate the equivalent number of substance based on the primary and secondary cloud. The employees are provided with the gas tanks. Percentage of the people harmed outside the building – 10 per cent, inside the building – 4 per cent.

Table 12: Characteristics of highly toxic substances and supporting coefficients for determining the depth of the infected zones

Highly toxic substance	*Density of highly toxic substance, t/m³*		*Boiling temperature, °C*	*Threshold toxic doze, mg·min/L.*	*Coefficients*		
	gas	*liquid*			*K1*	*K2*	*K3*
Ammonia: *pressurized storage,* *isothermal. storage*	*0,0008* *0,0008*	*0,681* *0,681*	*-33,42* *-33,42*	*15* *15*	*0,18* *0,01*	*0,025* *0,025*	*0,04* *0,04*
Hydrochloric acid (concentrated)	*-*	*1,198*	*-*	*2*	*0*	*0,021*	*0,30*
Chlorine	*0,0032*	*1,553*	*-34,1*	*0,6*	*0,18*	*0,052*	*1,0*
Ethyl mercaptan	*-*	*0,839*	*35,0*	*2,2*	*0*	*0,028*	*0,27*
Methane	*0,0006*	*0,416*	*-101*	*-*	*1*	*0,015*	*0,36*
The broad fraction of light hydrocarbons of propane	*0,0015*	*0,518*	*-43*	*-*	*0,18*	*0,052*	*0,27*
Oil, gasoline	*0,0021*	*0,65-0,85*	*35-360*	*-*	*0*	*0,021*	*0,36*

Table 13: An equivalent amount of emergency chemically hazardous substances

An equivalent amount of emergency chemically hazardous substances, t															
0,01	*0,05*	*0,1*	*0,5*	*1*	*3*	*5*	*10*	*20*	*30*	*50*	*70*	*100*	*300*	*500*	*1000*
0,38	*0,85*	*1,25*	*3,16*	*4,75*	*9,18*	*12,5*	*19,2*	*29,5*	*38,1*	*52,6*	*65,2*	*81,9*	*166*	*231*	*363*

Amount of victims during the spill of emergency chemically hazardous substances at most of the plants are determined based on the assumption that there will be harmed 100 per cent of people outside the building and 50 per cent of people inside the building.

During free spill density of emergency chemically hazardous substances is assumed to be 0,05 m.

When spill of emergency chemically hazardous substances happens, the primary cloud is formed (immediate evaporation), and secondary cloud is formed (evaporation of the liquid layer).

$\mathbf{Q_{Э1}}$, equivalent amount of substance, is determined based on the primary cloud (with respect to chlorine) by the formulae:

$$\mathbf{Q_{Э1}=K_1*K_3*Q_0} \quad (1),$$

Where:

$\mathbf{K_1}$ – coefficient dependent on storage conditions of emergency chemically hazardous substances, for compressed gases $\mathbf{K_1 = 1}$, for oil and gasoline $\mathbf{K_1 = 0}$;

$\mathbf{K_3}$ – coefficient equal to the ratio of chlorine threshold toxic doze to the threshold of another emergency chemically hazardous substance, $\mathbf{K_3}^{=}$ **0,36**;

$\mathbf{Q_0}$ – amount of the oil spill in the accident, $\mathbf{Q_o = 1,4\ t}$.

Determine equivalent amount of substance $\mathbf{Q_{j2}}$ based on the secondary cloud by the formulae (in tons):

$$\mathbf{Q_{Э2}=(1-K_1)*K_2^{0,2}*K_3*Q_0/(h^{0,2}*d^{0,2})} \quad (2),$$

Where:

$\mathbf{K_1}$ – coefficient dependent on the storage conditions of of emergency chemically hazardous substances (Table 12), for oil and gasoline $\mathbf{K_1 = 0}$;

K_2 – coefficient dependent on the properties of of emergency chemically hazardous substances, **K_2 = 0,021** (Table 12);

K_3 – coefficient equal to the ratio of chlorine threshold toxic doze to the threshold of another emergency chemically hazardous substance, **K_3 = 0,36**;

d – density of emergency chemically hazardous substance, **d = 0,82 т/м^3**,

h – thickness of highly toxic substances.

Case study 4

We will calculate the amount of payments for pollution of water objects. The enterprise is located in the basin of the Ob River (Altai Republic). Annual intake in water body with sewage of the polluting substances, and also the set limits and standards are given below:

Table 14: Annual intake in water body with sewage of the polluting substances, limits and standards

Substances	*Sulfates*	*Chlorides*	*Nitrates*	*Weighted substances*
Actual mass, ton	*10*	*45*	*5*	*15*
Standard (LAP, ton)	*10*	*35*	*4*	*10*
Limit (Temporary Approved Discharges, ton)	*-*	*40*	*5*	*15*

Case study 5

Treatment technologies have allowed reducing pollution of atmospheric air in comparison with data of table 1 to the following substances: carbon oxide - for 20%; nitrogen oxide - for 30%; carbon soot - for 1,5%. Determine decrease in the extent of economic damage from environmental pollution by the listed substances. To adopt the amendment f equal 1.

Table 15: The annual volume of emissions of the polluting substances in the atmosphere, tones

№ of enterprise	*Sulfur dioxide*	*Carbon oxide*	*Nitrogen oxide*	*Hydrocarbon*	*Solid particles (soot)*
1	*62,70*	*58066,80*	*9541,10*	*322253,30*	*3252,90*
2	*370,30*	*9819,90*	*3091,90*	*9632,10*	*388,10*
3	*23,30*	*3847,10*	*1360,30*	*3834,90*	*24,50*
4	*98,70*	*10 162,70*	*13580,40*	*20 568,20*	*75,00*
5	*22,50*	*207076,40*	*82540,10*	*133 330,00*	*418,90*

Case study 6

In the territory of the city two industrial enterprises work. Annually volumes of their wastewater into the Kama River make:

1st enterprise: 5 tons of copper, 2 tons of arsenic, 6 tons of oil;

2nd enterprise: 3 tons of synthetic surface active substances, 50 t of formaldehydes, 30 t of weighted substances, 20 t of zinc.

Determine the specified mass of the polluting substances coming to the river, and annual economic damage from pollution of the river.

The economic assessment of damage to natural reservoirs is calculated by the following formula:

$$У = \gamma\sigma \ M,$$

Where:

У - the size of economic damage from pollution of water objects, rub.;

у - the size of specific damage from pollution, rub/t (443.5 rub/conv. t.);

σ - the amendment considering category of water objects;

M - the specified mass of pollutants discharge, conv. t.

Take missing data from open sources.

Case study 7

160 thousand tons/year of harmful substances come to the atmosphere of the city. Emissions of harmful substances have the following structure: 26% - sulphurous gas; 43% - carbon monoxide; 16% - timber dust; 7% - nitrogen oxide; 8% - nickel oxide. Define annual economic damage from pollution of the atmosphere. The amendment on nature of dispersion of impurity to the atmosphere is 0,89; type of the polluted territory is the territory of industrial hubs and the industrial enterprises.

Calculation of annual values of economic damage from pollution of atmospheric air is determined by a formula:

$$У = \gamma\sigma \; f \, M,$$

Where:

У - the value of economic damage from pollution of environment, rub;

γ - the value of specific damage from pollution of environment, rub/t (2,4 rub/t);

σ - the amendment considering character of the territory on which influence is carried out;

f - the amendment considering nature of dispersion of impurity in the atmosphere;

M - the specified mass of the polluting substances, conv. t defined as product of the actual mass of the discharged substance and an indicator of its relative danger.

Case study 8

Determine the extent of economic damage from placement of production wastes and consumption by the data provided in table 3.

Table 16: Data on the damage caused to land and soil resources

№	Area	Type of the territory	Nature of influence
1	100 м^2	Recreation area within the city, the Leningrad region	Unauthorized placement of solid household waste
2	10 км^2	Solid waste landfill area, Moscow area	Solid waste landfill area
3	15 м^2	Enterprise territory, Moscow	Placement of waste of the I class of danger
4	3 км^2	Territory of the landscape wildlife area, Kostroma region	Unauthorized placement of industrial wastes of the III class of danger
5	100 м^2	Territory of railway station, Moscow	Emergency flood of 3 t of acetic acid
6	300 м^2	Moscow area	Formation of ravines owing to irrational use of agricultural grounds
7	3 км^2	Green belt, Moscow	Damage to land resources in result of the fire
8	250 м^2	Railway station, Moscow area	Oil spill

The extent of damage from littering of lands by unauthorized landfill sites is determined by a formula:

$$У^{П}_{прс} = \sum_{i=1}^{N} (Н_c S_i К_э К_П),$$

Where:

$У^{П}_{прс}$ - assessment of size of the prevented damage from littering of lands of i-category of waste (i = 1, 2, 3..., n) for the reporting period of time (one thousand rub/year);

Si - the land size where it was succeeded to prevent littering by waste of i-type for the reporting period of time, hectare.

Case study 9

The administration of the enterprise is considering replacement of the electrical power system of the office situated in the city centre. Currently, the energy provider is a company that charges three rubles per one kWh. It is planned to acquire a set of the solar battery kits, which would provide the office with energy and would allow the enterprise to go without the energy providing company.

Determine:

1) The amount of electricity consumed by the office in one day (Table 1), and the current annual electricity cost (office is open all year round without holidays and weekends).

2) Capital investments on acquiring a set of the solar battery kits, which would provide the office with energy (Table 2).

3) The payback period for capital investments.

4) The Expediency of replacing electric power supply of the office.

Table 17: Office electricity costs

Type of equipment, power consumption, work time during the day					
1	*2*	*3*	*4*	*5*	*6*
Laptop, 30 W, 8 h	*Lighting, 40 W, 8 h*	*Printer, 500 W, 15 min*	*Fax, 10 W, 10 min*	*Teapot, 2 kW, 15 min*	*Fan, 100 W, 4 h*

Table 18: Cost of the solar battery kits

Equipment description	*Wh/day*	*Cost, rubles*

Kit Super 130W 12V (2 x 65W), NC15A - АКБ 220Ah 12V (110Ah 12Vx2)	*520*	*59220*
Kit Super 170W 12V	*680*	*77700*
Kit Super 200W 24V (2 x 100W), NC30A - АКБ 100Ah 24V avto (100Ah 12V x2)	*800*	*82320*
Kit Super 260W 12 V	*1040*	*115080*
Kit Super 300W 24V (3 x 100W), NC30A - АКБ 200Ah 24V AGM (200Ah 12V x2)	*1200*	*118440*
Kit Super 400W 24V (4 x 100W), NC30A - АКБ 240Ah 24V AGM (120Ah 12V x4)	*1600*	*118440*
Kit Super 600W 24V (6 x 100W), NC30A - АКБ 400Ah 24V AGM (200Ah 12V x4)	*2400*	*226800*

Calculation of the amount of electricity consumed by the office in one day, is determined by the formulae:

$$\mathrm{Rd} = \sum_{i}^{n} N_i t_i$$

Where:

R_d – daily energy consumption, Wh;

N_i – power of i-type of equipment, W;

t_i – time of work of i-type of equipment, h.

Current annual electricity cost is:

$$S_г = \frac{R_д \cdot C \cdot 365}{1000},$$

Where:

S_r- annual electricity cost, rubles;

C – rate for 1 kWh, rubles.

According to the value of R_d, the needed amount of solar panel kits is determined by the Table 2, and total expenses on their acquisition are calculated (K).

Payback period is calculated by the formulae:

$$Q=K/S_r$$

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Abbreviations and acronyms

CH4	Methane
CO	Carbon monoxide
CO2	Carbon dioxide
EEA	European Environment Agency, http://www.eea.europa.eu/
EMEP	The European Monitoring and Evaluation Programme
ERA	European Research Area
ESPON	European Observation Network for Territorial Development and Cohesion
Eurostat	The Statistical Office of the European Union
GHG	Greenhouse gas; the most important anthropogenic greenhouse gases are carbon dioxide (CO2), methane (CH4), and Nitrous oxide (N2O)
ICP	Forests International Co-operative Programme on Assessment and Monitoring of Air Pollution Effects on Forests
IPCC	Intergovernmental Panel on Climate Change http://www.ipcc.ch/
NMVOC	Non-methane volatile organic compounds
NOx	Nitrogen oxides
NO2	Nitrogen dioxide
O3	Ozone
PM10	Particles in the atmosphere with a diameter of less than or equal to a nominal 10 micrometres
PM2.5	Particles in the atmosphere with a diameter of less than or equal to a nominal 2.5 micrometres
SRES	Special Report on Emissions Scenarios http://www.ipcc.ch/ipccreports/sres/emission/index.php?idp=0
UNECE	United Nations Economic Commission for Europe http://www.unece.org/
WHO	World Health Organization

REVIEWS

Review

Scientific monograph entitled “Environmental management & audit“ is the result of Tempus Lifelong learning project RECOAUD. The monograph transparently represents some issues and challenges of environmental management, which tries to respond to climate change and ecological scarcity. The monograph unites contributions from European and Russian scientists from different scientific areas, thus it provides more holistic approach to the same thematic. The monograph should therefore reach especially wide target group of readers, as they can be recognized in students, experts from industry as well as in teachers.

The reader of the monograph gets a comprehensive overview and presentation of environmental management and audit at the theoretical level in the considered specific areas. In the monograph the results of research in the field of environmental management and audit, as well as trends and challenges in the development of this field are highlighted.

Monograph “Environmental management & audit“ consists of 4 books – Scarcity and Introduction of Environmental Management, Management Systems, Controlling and Stakeholders, and Environmental Assessment (Featured Articles). These topics represent the complexity, heterogeneity and multidisciplinary of the project Tempus RECOAUD.

In terms of the content, structure and the holistic approach from diverse international group of authors to this monograph, I conclude that the monograph completely fulfills the preconditions for a scientific monograph, thus it deserves to be published by the International publisher SPH.

Reviewer:
BAGRAT YERZNAKYAN
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Review

This scientific monograph “Environmental management & audit“ is the result of three-year work on an international project entitled "Environmental management in Russian companies – retraining courses for the sensibilization for and integration of Eco-Audit programs in corporate decision-making (RECOAUD)". It contains more than 600 pages of interesting text written by 31 authors from EU and Russian Federation, edited by dr. Borut Jereb, Darja Kukovič and dr. Daria Meyr.

The monograph is well structured and contains different forms of content – whether it is formed as chapters and subchapters or as articles, which has been written on a high level of methodological and research standards.

In the first part of the monograph, Scarcity, the Framework of Environmental management and Environment management systems are represented. Second part represents Supply chain and Value chain Management, Logistics and Transport with Case studies at the end. The third part talks about Controlling and Stakeholders. The last part contains featured articles on Environmental assessment issues.

The monograph is the result of successful scientific and inter-faculty cooperation. It is useful for those who engage in the field of environmental management and audit in science and practice, or it can be used for study purposes. Thus, the contents of monographs meets the conditions for a scientific monograph, therefore I recommend it to be published.

Reviewer:
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