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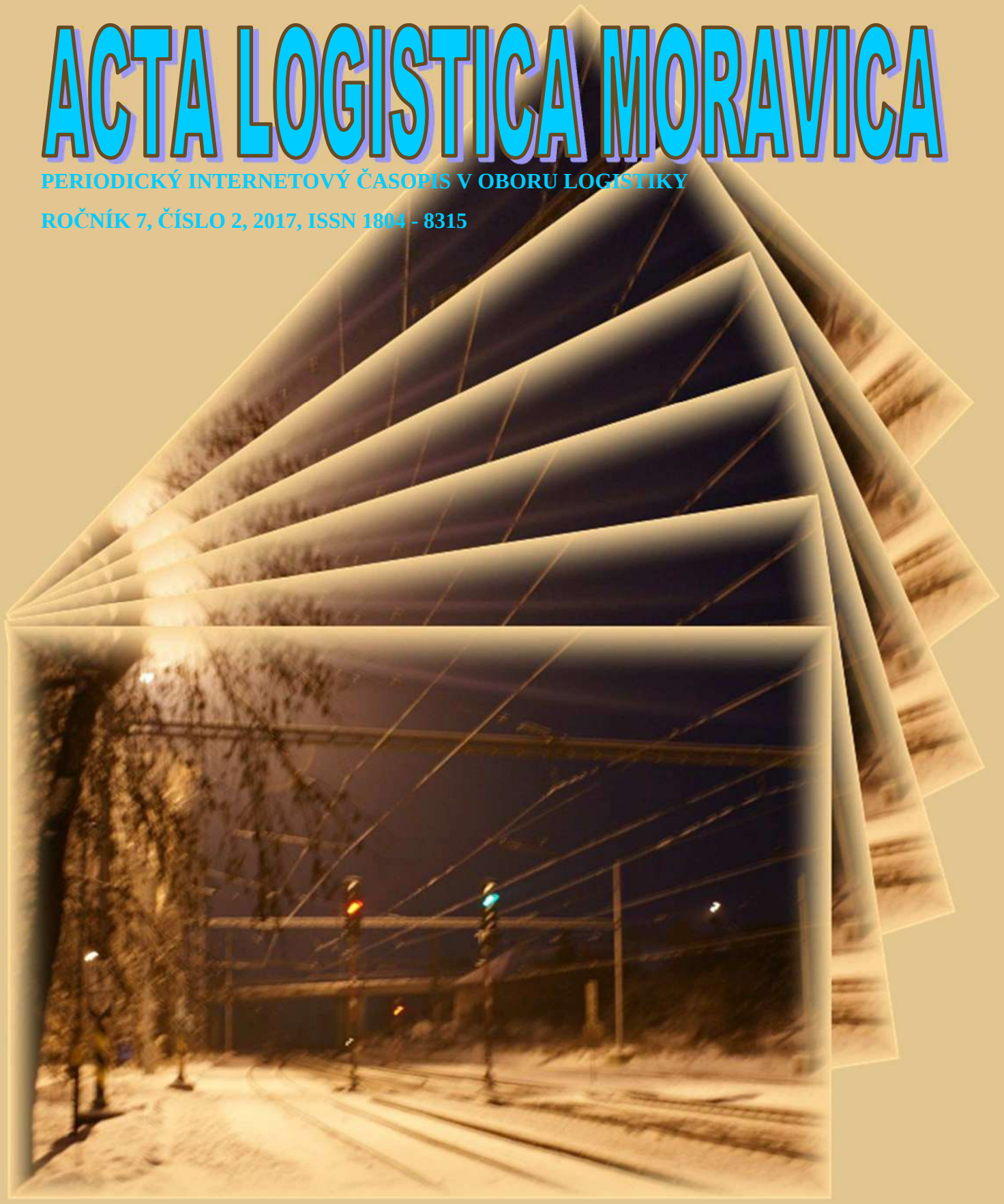

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Acta Logistica Moravica

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Pokrokové metody v logistice

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CONTENT

INNOVATIVE TRENDS IN LOGISTICS

INOVATIVNÍ TRENDY V LOGISTICE

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Abstract

Innovations are based on a focused search for changes and a systematic analysis of the economic and social potential which these changes offer. Innovation Management is a systematic approach to the implementation of those changes which should aim to improve the products, processes, or position of an enterprise. Concepts which are often discussed in the context of logistics include efficiency, organization, or value-creating chain. By contrast, the concept of innovation occurs quite rarely in this domain. It is considered mostly in the technical dimension of the logistics solutions including, for example, a more efficient use of warehouse technology, introduction of energy-saving vehicles (or autonomous transport systems), or implementation of high-performance information systems.

Abstrakt

Inovace jsou založeny na cílevědomém vyhledávání změn a na systematické analýze možností ekonomických nebo sociálních inovací založených na těchto změnách. Inovační řízení je systémový přístup k realizaci změn, které by měly mířit ke zlepšení produktů, procesů nebo pozice celého podniku. V souvislosti s logistikou se velmi často hovoří zejména o efektivnosti, organizaci nebo hodnototvorném řetězci. Pojem inovace v logistice se naproti tomu objevuje spíše zřídka. Většinou se jedná o technickou dimenzi logistického řešení jakými je např. efektivnější využití skladovací techniky, použití úspornějších vozíků, resp. autonomních dopravních systémů, implementace výkonnějších informačních systémů apod.

Key words

Innovation, information technology, autonomous transport systems, supply sequencing, picking

Klíčová slova

inovace, informační technologie, autonomní dopravní systémy, sekvenční zásobování, pickování

INTRODUCTION

Innovations which allow a reduction in the costs and an increase in the efficiency of planned and performed processes are beneficial for every organization. Increased efficiency is important not only from the short-term perspective, but also with respect to sustainability and applications in the workplace and in the whole company.

Innovative trends in logistics are related to the concept of Industry 4.0. Covering also the concept of the Internet of Things (IoT), this term basically refers to modern devices equipped with built-in controllers which can be operated remotely via the Internet. Today, experts often

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discuss the compatibility within the IoT.

At present, there is a gradual integration of various logistics activities throughout the value-creating chain, from the provision and delivery of raw materials, through the production and identification of goods to the packaging and distribution to the customers. The integration of these logistics activities is closely related to the implementation of information systems in the manufacturing technologies, machines, equipment, and hardware used.

The largest spread of innovations can be seen in warehousing where both the qualitative and the cost aspects of the process are affected mainly by labor force, more precisely the combination of features including, for example, experience, diligence, responsibility, stress resistance, manual dexterity, but also loyalty to the employer. Given the real qualities of people who are available on the labor market for the area of warehousing and handling as well as the conditions which the warehouse manager can provide to them in the existing cost framework, it is practical to eliminate the impact of the labor force on the quality of the picking as much as possible [4].

1 FULLY AUTOMATED WAREHOUSE

A Warehouse Management System (WMS) enables automatic management of warehouse operations across all logistics processes, from ordering goods from a supplier to shipping them to a customer. Different methods of automatic identification are used, such as barcodes, Radio Frequency Identification (RFID), wireless data transmission, and voice technologies [3].

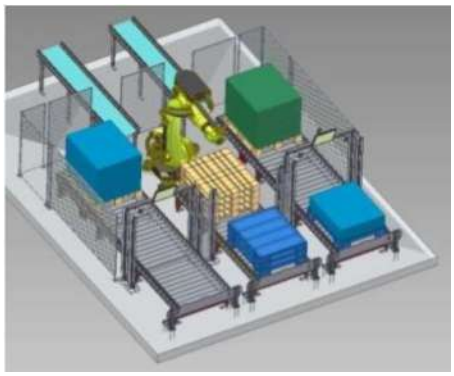

Fig. 1 Scheme of a fully automated warehouse system [3]

The main advantages of automated warehouses include automated put-away and picking operations (i.e. at the receiving and dispatch of goods), minimizing errors resulting from manual control and management, tracking and order keeping, reception checking, monitoring and inventory updating, as well as unattended operation.

Fig. 2 Automatic warehouse stacker [1, 2]

Automated warehouses are suitable to store from hundreds to tens of thousands of inventory items, or if there is a large turnover requiring an extremely rapid picking response and a minimal error rate of the process.

2 PICKING SYSTEMS (PICK BY SYSTEMS)

Picking is one of the most cost intensive operations in the warehouse. It is also among the most important processes influencing performance indicators for each warehouse. The way picking is performed and organized has a significant influence on the accuracy and quality of the logistics units produced. The growth in picking operations is caused by the continuous reduction in the volume of supplies and the increase in their frequency caused by the effort to minimize inventory levels in the supply chain and the increasing number of online stores. Thus, warehouse managers are constantly forced to deal with the issue of streamlining and improving the picking process.

Semi-automatic picking methods use either a combination of manual item selection with automatic transport of crates to the picking area, or automated transport of a warehouse operator to the location where the item for picking is stored. Forklift trucks, automated stackers, roller conveyors, or horizontal and vertical rack systems are preferably used.

The most widely spread picking technologies include [4]:

- Pick-by-Light (by means of data displays mounted to the shelf trims),
- Put-to-Light (an opposite approach to Pick-by-Light technology),
- Picking Cart,
- Pick-by-Voice (picking with voice navigation),
- Pick-by-Point (picking locations are indicated by a kind of strobe light beam),
- Pick-by-Frame (picking with a movable frame where the correct slot is indicated by a light signal),
- Pick-by-Box (designed for automated picking of small components),
- Pick-by-Vision (picking by using augmented reality and smartglasses).

Pick-by-Light [6]

The technology uses data which appear on a display located directly on the trims of a

shelving or gravity rack. It includes simple light indicators and one or more confirmation buttons. A control center provides instructions directly to a warehouse operator who is located in a predetermined storage section.

Fig. 3 Pick-by-Light [8]

Fig. 4 Pick and Put-to-Light [9]

Put-to-Light [9]

The Put-to-Light technology is based on the opposite principle to Pick-by-Light. The warehouse operator collects goods required in a picking order and puts them to designated crates or containers in given positions which are also equipped with displays showing necessary data. The displays identify the goods by means of barcode scanners or RFID. After putting goods into a crate the operator confirms the action by pressing a button.

Pick-by-Voice [7]

The warehouse operator receives information about picking through a headset and confirms its acceptance and comprehension by a voice command. The communication consists of a simple dialogue. The operator carries a terminal located on a belt or on a wrist which is connected by cable or wirelessly to an earpiece with a microphone (headset). Each operator has his own voice profile recorded in the terminal which enables the system to cope with differences in pronunciation and facilitates voice analysis. When one task is completed, the operator receives the next location address for picking. The process is repeated until the entire order picking is completed. Then the operator prints a shipping label. The system verifies that the printed label is correct and determines a location to place the pallet.

Fig. 5 Pick-by-Voice [7]

Fig. 6 Scheme of a Pick-by-Voice system [13]

Pick-by-Point [12, 14]

The innovative Pick-by-Point technology complements the Pick-by-Light and Pick-by-Voice systems. The biggest advantages include its extraordinary flexibility and low installation costs.

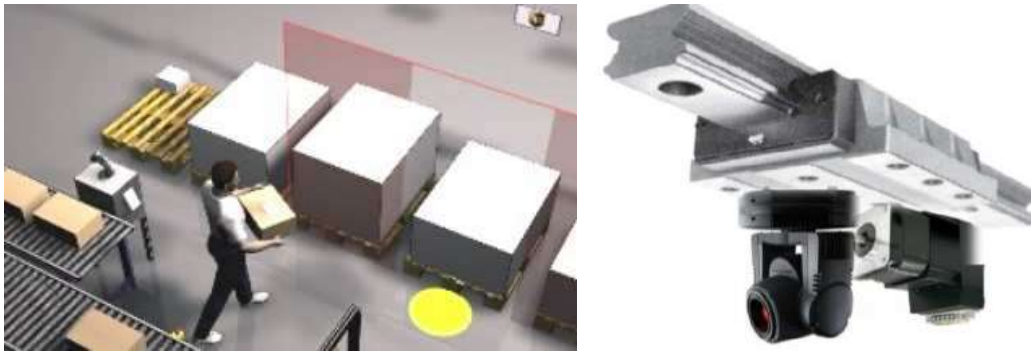

Fig. 7 Pick-by-Point [14]

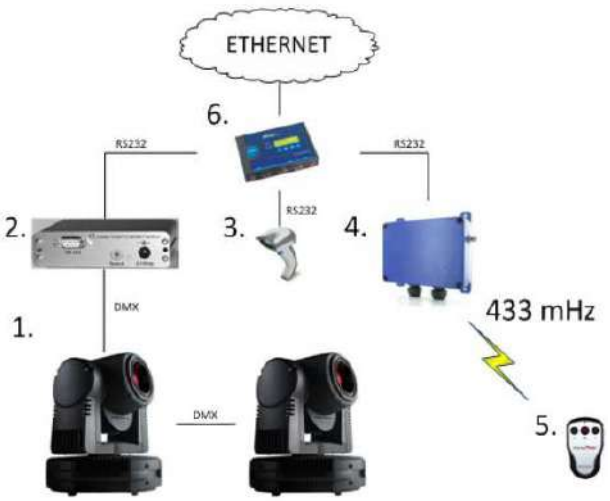

Fig. 8 Control scheme of a Pick-by-Point system [12]

Pick Term Sentinel [4]

In this method each selected storage section is equipped with a device for monitoring the picking process. A sensor of this monitoring system is located directly above the warehouse section and is assigned to a specific display on a shelf or rack.

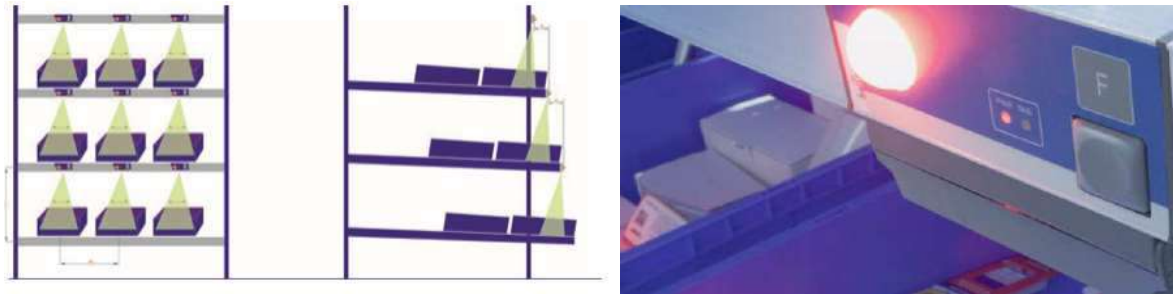

Fig. 9 Pick Term Sentinel [4]

Pick-by-Frame [20]

This technology uses a frame mounted on a truck. The central display shows a barcode which is scanned with a barcode scanner to load information about the required order.

The operator confirms the order by pressing ENTER and starts the picking process. After finding the appropriate item, the operator scans its code or the storage location code. The slots in which the items should be put are indicated by lighting side displays.

Fig. 10 Pick-by-Frame [20]

Pick-by-Vision [3]

This method works in combination with smartglasses which show an arrow indicating the direction (see Figure 11 on the right).

Fig. 11 Picking by means of smartglasses [3]

ProGlove (smart glove) [3]

Fig. 12 Smart glove [3]

It is an electronic glove with a built-in scanner which allows the operator to scan items quickly and conveniently. Recording data or inventory check reflects the natural movements of human hands. Codes can be scanned both vertically and horizontally. The codes are confirmed with a button on the index finger.

3 AUTONOMOUS VEHICLES

Automated guided vehicles (AGV, FTS) have been replacing conventional vehicles such as forklift trucks, hand pallet trucks, and other means of transport in almost all industries. Navigation methods vary from wire systems through laser guidance to magnetic tapes which appear to be the simplest solution.

Automated tuggers move along magnetic lines towing multiple trailers with material picked from the stock. They run in sequences required by the assembly line. A risk of collision is identified by sensors mounted on the vehicles which monitor the routes and their two meter surroundings. If necessary, AGVs can stop virtually immediately, but to avoid undesired frequent stops, they play music to be easily spotted.

Fig. 13 Automated tugger guided by a magnetic tape [18]

Fig. 14 Fleet of automated tuggers [18]

Fig. 15 Assembly line supply [18]

Fig. 16 Scheme of an intelligent assembly line [2]

4 PACKAGING AND SHIPPING [2, 18]

The basic categorization of packaging is based on the weight of packaged products:

- up to 15 kg:
  - universal
  - special
- over 15 kg
  - universal
  - special

Fig. 17 Universal KLT containers [18]

Fig. 18 Special packaging for components
of a single type [18]

Fig. 19 Large universal containers [18]

Fig. 20 Assembly of large special containers [18]

Fig. 21 Wooden transport frame for car bodies [18]

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RAIL TRANSPORT IN LOGISTICS

POSTAVENÍ ŽELEZNIČNÍ DOPRAVY V LOGISTICE

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Abstract

Transport is an important element of the logistics system. All types of conventional transport are used in logistics, namely road, rail, water and air transport. Each mode of transport has its specific application in the logistics chain due to its characteristics. Rail transport has an irreplaceable place in the logistics chain, particularly for the transport of larger quantities of goods over longer distances. The article focuses on the issue of the use of rail transport in logistics. The paper is aimed at the issue of the use of rail transport in logistics.

Abstrakt

Doprava je důležitý prvek logistického systému. V logistice se uplatňují všechny čtyři druhy konvenční dopravy – silniční, železniční, vodní a letecká. Každý druh dopravy má vzhledem ke své charakteristice specifické uplatnění v logistickém řetězci. Železniční doprava má v logistickém řetězci nezastupitelné místo zejména pro přepravu většího množství zboží na delší vzdálenosti. Článek je zaměřen na problematiku uplatnění železniční dopravy v logistice.

Key words

rail transport, wagon delivery, individual delivery, complete train, container train

Klíčová slova

železniční doprava, vozová zásilka, jednotlivá zásilka, ucelený vlak, kontejnerový vlak

INTRODUCTION

Individual transfer, animal or freight transport play an essential role in our society. Transport is so called cross-section activity within logistics. All conventional and non-conventional modes of transport participate in freight transport. Rail transport belongs together with road transport among the basic transport systems in Central Europe. Rail transport plays an essential role in logistics.

1 TRANSPORT AS AN IMPORTANT ELEMENT OF THE LOGISTICS SYSTEM

Transport represents a set of activities ensuring the move of transport means on transport routes. **From the logistics point of view, transport is the most important element of the logistics system. Logistics transport is a part of logistics chain**. Comparing the economic concept of transport, logistics transport is integrated onto the logistics system characterised by the synergy effect.

The basic function is to realize transport. It is the act of moving tangible objects (goods or animals) from the place or origin to the place of destination with related activities, loading,

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unloading and control operations. It is necessary to have suitable transport network, high-quality transport routes and secure operations. [1]

The transport system is functional if the following factors are balanced:

- logistics transport booking service,
- technology capacity of transport,
- quality of transport. [1]

To move the product means double benefit in transport - benefit of place and benefit of time. Both mean added value but do not increase the use value of the product.

Logistics activities connected to transport give a share in 38 % of logistics costs. Sometimes transport is perceived as rather cheap with compared to the storage costs or inner supply. The transport requirements are very high together with the modest use of transport means. This causes many empty drives, low backward workload and Just in Time requirements. [2, 3]

2 RAIL TRANSPORT

Rail transport is a conventional transport system participating at global transport. It is the transport on railway. It has got its specific and essential place in the national economy and in logistics.

Rail freight transport is a set of activities ensuring transport of goods and animals by rolling stocks, or transport of railway vehicles on railway. It is suitable to transport large volumes of goods for long distances. [4]

Currently the rail transport does not have such high share in the transport market as it used to have in the past. However, the share in division of transport labour should raise in the future. The aim of the European Transport Policy is to convert 30 % of current road transport above 300 km to railway, eventually to water transport. Figure 1 presents estimations of the division of transport labour between particular transport sectors in the Czech Republic in 2030, compared to 2015.

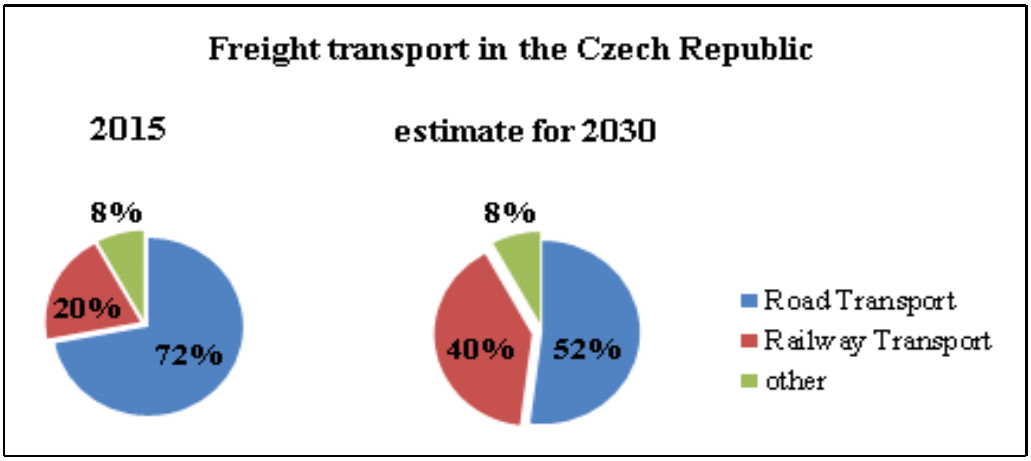

Fig. 1 The share of the transport sector in freight transport in the Czech Republic in 2015 and estimated for 2030

Source: https://www.mdcr.cz [2]

The advantages of rail transport are to transport large volumes of different freight, lower costs for long distances, high-security of transport, low energy performance, low dependency on environmental conditions, independence on traffic flow intensity on roads, environmental

performance etc. Disadvantages are impossibility of door-to-door delivery (except of railway sidings), limited flexibility, complicated technology of transport, etc. There are also opportunities in rail transport, such as cooperation with other modes of transport, or to use intermodal intra-continental and inter-continental transport.

3 RAIL FREIGHT TRANSPORT

Rail transport enables to move different types of goods including dangerous goods or non-standard consignments, that means heavy or oversized goods.

Generally, it is possible to transport:

- wagon delivery,
- single-piece delivery,
- express delivery.

Rail transport providers currently offer and realise transport of wagonloads.

Wagonload is a consignments that needs at least one single wagon for its transport. It has to contain a waybill. Wagonload means also an empty or bulk container or a swap body transported on the rolling stocks, or a rolling stocks in empty or bulk state, that are not owned by the carrier and are sent by consignor with a waybill. [3]

Wagonloads can be transported as:

- individual deliveries,
- complete trains.

Individual deliveries enable to move smaller volume of goods. Transport of wagon deliveries utilizes one wagon or a group of railway wagons (maximum of five). ČD Cargo is the only transport provider to offer this type of transport in the Czech Republic and in the whole network of SŽDC, and also on the railways of other private companies. To deliver abroad it cooperates with foreign partners, also in a great part of European railway network.

The wagons are transported from the consignor to the recipient using a common train-formation route. The indicated plan specifies the route and particular trains carrying the consignment. Individual deliveries respond to the market and are convenient for transport of smaller volumes into more destinations (see Figure 2 and 3). [6]

Fig. 2 Example of wagonload in one wagon - individual delivery

Source: https://www.cdcargo.cz/katalog-nakladnich-vozu

Fig. 3 Freight train with individual wagon delivery

Source: http://www.fotodoprava.com foto Bedřich Zenáhlík

Single wagons are collected from the dispatcher by a local (i.e. handling) train to the nearest shunting yard. They are further dispatched by long distance train (i.e. running, potentially freight express) into the closest shunting station to the recipient, and then delivered by local train. Figure 4 shows the described scheme.

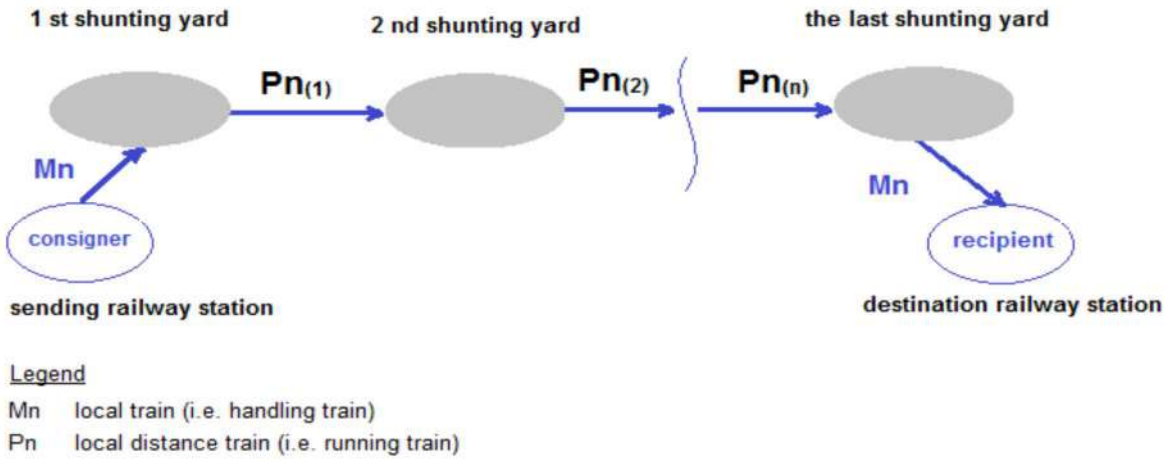

Fig. 4 Scheme of the transport of single wagonloads

Source: own

Complete trains are shunted from the wagons transporting only one delivery, and they are transported directly from the consignor to the recipient without any shunting works. The delivery travel period is significantly reduced, and due to simplified handling, the transport by complete trains is significantly more beneficial in price. The complete trains represent the most suitable method of transport for large volume deliveries. Figures 5, 6 and 7 show the examples of transport in complete trains.

The following types of complete trains are offered by rail transport:

- direct complete train,
- grouped complete train,
- diffused complete train.

Fig. 5 Complete train with coal

Source: http://www.fotodoprava.com foto Bedřich Zenáhlík

Fig. 6 Complete train with cars from Mladá Boleslav

Source: http://www.fotodoprava.com foto Bedřich Zenáhlík

Fig. 7 Complete tank train of the Unipetrol Transport Company

Source: http://www.fotodoprava.com foto Bedřich Zenáhlík

The trend in rail freight transport is to use complete trains. It is the most economic option of freight transport. New railway providers in railway freight transport, such as Unipetrol Transport, Advanced World Transport, METRANS Rail etc., started to operate complete trains. ČD Cargo, as the biggest rail transport provider, is also able to organize transport of the complete train in Europe. The most common commodities transported in complete trains are coal, cement or different substances in tanks. [7, 8, 9]

4 RAIL TRANSPORT SYSTEM IN COMBINED TRANSPORT

At the beginning of the 21st century, rail transport can undoubtedly find its place in the system of combined transport.

Combined transport is a system of transport in one transport unit (container, swap body, etc.) or in road vehicle using also rail or water transport. It means that goods are placed in one unit, while the unit is transported by several modes of transport. Only the transport unit is reloaded, not the goods itself.

Combined transport uses advantages of all modes of transport. Rail and water transport belong to cheaper possibility for long distances transport, while road transport is suitable for short distances.

Rail transport has its place in the system of combined transport to transport:

- containers within container transport system,
- swap bodies,
- semi-trailers,
- trucks on wagons in the system Ro-La (Rollende Landstrasse – especially in the Alpine region),
- roller container – system ACTS (Abroll-Container-Transport-System), etc.

Transport within container transport system creates a significant share in the system of combined transport (Figure 8). It is related to the development of container sea transport using unified transport units ISO 1 (especially 40´ containers ISO 1 A and 20´ containers ISO 1 C). Vertical method of manipulation is used by reloading - grabbing the container through its upper corner components.

Fig. 8 Complete container train of the METRANS Rail Company

Source: http://www.fotodoprava.com foto Bedřich Zenáhlík

Rail transport providers and operators of combined transport (e.g. ČD Cargo, METRANS Rail, Advanced World Transport) offer transport of big containers into important sea ports and in return. Trains carrying containers run either regularly or ad hoc. [10, 11, 12]

Recently the connection of Europe and Asia by railway experiences a big boom. Especially containers are transported here. Rail inter-continental transport is faster and more time reliable compared to the sea transport. It is slower compared to air transport, which is however more expensive.

CONCLUSION

The European Union and its member states pay particular attention to transport and logistics of freight transport. The strategic and conceptional documents emphasise the share in division

of transport labour in order to develop advantages of particular modes of transport and to provide efficient logistics services. This should help to fulfil the strategic goals as reducing of energy performance and impact on the environment.

Rail transport has its significant place not only in the national transport system, but also in logistics processes. To develop rail transport and its application in logistics chain, it is important to modernise rail transport system and to apply modern systems of combined transport.

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THE PREVENTION OF FLOODS IN THE CZECH REPUBLIC

PREVENCE POVODNÍ NA ÚZEMÍ ČESKÉ REPUBLIKY

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Abstract

The outflow of almost all water from the hilly regions of the Czech Republic into neighbouring countries, from which no water comes to our country leads us to the signification as the „Roof of Europe“. The absolute dependency of our water resources on rainfalls causes, that in period of their fluctuation the water regime has to face the hydrologic extremes – floods and draught. This was reflected in activity of citizens and water managers in building dams and large ponds in order to catch the flood and afterwards to ensure water for period of draught.

Abstrakt

Odtok téměř veškerých vod s kopcovitého území České republiky do sousedních států, odkud k nám prakticky nic nepřitéká, vede k označení našeho území jako „střecha Evropy“. Absolutní závislost našich vodních zdrojů na atmosférických srážkách způsobuje, že v důsledku jejich rozkolísanosti je vodní režim vystaven hydrologickým extrémům – povodním a suchu. Tomu také odpovídala činnost vodohospodářů a obyvatel již historicky, kdy vznikaly přehradní nádrže a velké rybníky k zachycení povodně a následně k zajištění vody pro překlenutí sucha.

Key words

antiflood protection measures, improvement of weather forecast services, modernization of equipment of Czech Hydrometeorological Institute, flood committee

Klíčová slova

protipovodňová opatření, zkvalitnění předpovědní služby, modernizace vybavení Českého hydrometeorologického ústavu, povodňová komise

INTRODUCTION

Drought is from the point of impact to water sources and furthermore to whole water economy even more complicated than floods. The existence of many catastrophic floods in recent 17 years (Chart 1) lead and has been leading to certain improvement of preventive measure with the aim to restrict the negative impacts of flood measures.

In 1997, nearly after 100 years without any big floods, the catastrophic flood in the region of Moravia appeared. By its range and extent it has overcome historical knowledge and experience. It was certain at the same time, that not only realisation of antiflood measure, but also appropriate legislative for controlling of rescue works and management of flood were passed. Such situations appeared in nearly all european countries which have been threatened by floods since 1990´s and they lead to imroving flood prevention including working out the stratégy which measure is necessary to realise in consideration with unpleasant situation. Buildings and exploitation of valley meadows along the rivers not only extremely restricted the possibilities of using these areas for harmless spill of water, but also higher technical equipment of buildings extremely increases flood damage.

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All given circumstances lead immediately after 1997 to searching of historical intentions of antiflood measures along important rivers of „Povodí“ and their division into priority in document called Generel of antiflood measures from 1998. [1]

Practically side by side started works for preparation of new legislative which can be used in flood situations for security works and also activities and equipment of fire brigade has been improved. Very strong local floods in river basin Elbe emphasized the needs of systematic measure. The Strategy of prevention from floods for the Czech Republic were approved by the government in 2000, which was formed by the Ministry of Agriculture in cooperation with the Ministry of Environment. The whole complex of laws (Chart 2), has been accepted gradually, which represents the quality set of regulations for the management of floods, organization and ensuring of security works, where public administration have been involved(village, municipality, regional authority).The set of given laws belongs to the best „flood „ legislative in Europe and since 2001 its utilization have been realized.

The quality of weather forecast service has been extremely improved by the modernization of equipment of the Czech Hydrometeorological Institute (radars, model SW tools) and by the enlargement of cooperation with foreign partners. The equipment of control rooms of „Povodí“ has been improved, Network of water measuring and rainfall measuring stations was improved as well. They are equipped with the long- distance transfer of data. It all enables the continuous awareness of citizens, but also application of mathematical models of progress of flood waves. The possibilities of manipulation in water dams for catching flow rates and limitation of the range of flood everywhere there could be depend on it.

Table 1 – Flood consequences in certain flood situations

Flood situation [years]	**Lost of people lives**	**Flood damages [mil. CZK]**	
		totally	**From this at dams**
1997	60	62 600	6 600
1998	10	1 800	
2000	2	3 800	606
2001	0	1 000	100
2002	16	75 100	4 630
2006	9	6 200	2 238
2009	15	8 500	1 392
2010	8	15 200	3 400
2013	15	15 400	2 196
total	**135**	**189 600**	**21 162**

Source: Ministry of Agriculture of the Czech Republic, water

„Flood legislative “of the Czech Republic – legal regulations accepted as a reaction to flood situations in previous years.

- Zákon č. 238/2000 Sb., o Hasičském záchranném sboru České republiky, v platném znění
- Zákon č. 239/2000 Sb., o integrovaném záchranném systému a o změně některých zákonů, v platném znění
- Zákon č. 240/2000 Sb., krizový zákon
- Zákon č. 254/2001 Sb., o vodách a o změně některých zákonů (vodní zákon), v platném znění
- Vyhláška č. 236/2002 Sb., o způsobu a rozsahu zpracovávání návrhu a stanovování záplavových území
- Statut Ústřední povodňové komise. Usnesení vlády č. 806 ze dne 25. srpna 2004
- Metodika stanovení aktivní zóny záplavového území. Ministerstvo zemědělství a ARCADIS a. s., Praha, 2005, 18 s. [1]

1 THE SUPPORT AND COOPERATION OF ANTIFLOOD MEASURES

The foreign support from Denmark and the Netherlands was very essential for development of model instruments which can be used for design of technical antiflood measure. They enabled (in studies of outflow ranges of „Povodí“ which was supported by the Ministry of Agriculture), to verify the effects of these technical constructions. The course of flood in Prague in 2002 confirmed very important role of these measures, when mobile barrier designed according to model in fact protected the historical centre of The Old Town.

Together with progress in weather forecast service, the mass expansion and improvement of mobile phones was realized which made transfer of information quicker and more accurate. The Ministry of Agriculture ensured in years 2005 – 2007 development of „Information system of public administration“ as a shared system of central authorities (e.g. Ministry of Environment, Ministry of Defence, Ministry of the Interior, Ministry of Health and Ministry of Transport). Concerning the prevention of floods, data about flow rate form the most important part of this system as well as the level of water surface in dams. The information from measuring centres are published both ČHMÚ and „Povodí“ for all citizens and moreover they are given in six languages (it means, they are available for citizens of neighbouring countries as well). This information system (www.water.gov.cz) is highly appreciated by neighbouring countries and many of them are building similar systems.

It can be said that the main role in the management of floods and controlling security works plays the intensive communication among these institutions – „Povodí, ČHMÚ, Operating centre of Fire brigade and flood committees. The technical development enables not only transfer of information, but also video-conference are being used – in 2013 was successfully done the first one in Operating center of Fire brigade and it influenced the communication between Central flood committee and Central Emergency Committee with county representatives very positively. [2]

In short we can say that since flood in 2002 very good communication and cooperation of all involved parties have been realized. [3]

It is necessary to emphasize the role of „flood committees“, which is crucial – not only while floods, but also in period without floods, because supervision of updating of floods plans (compulsory according to law 254/2001 Col.)and its maintaining helps to restriction of flood damages. Delimination and subsequent assessment of flood areas (including „active zones“,

where no construction is allowed) has the essential meaning for local plan of municipality. Unfortunately, there are still such cases, where local authorities give preferences to development plans of municipality to threat of flood situations and they allow building activity regardless the opinion of „Povodí“.

2 SUBSIDY PROGRAMME OF MINISTRY OF AGRICULTURE

Restriction of local extent of flood and decreasing of flood damages are ensured by technical antiflood measures – building dikes, making bigger capacity of river beds, adjustment of dam handling mechanism and first of all making retentions (polders, basins, expanding existing accumulations), which are the content of donating programme of Ministry of Agriculture and its phases are realized by the administrators of rivers. A summary of certain phases is in chart 3. For realization of measure it is necessary to have lower expenses for its construction than the value of protected property. The evaluation of actions in phase 1 of programme (2002 – 2007) shows that investment in the height of 4,1 billion CZK has brought an increased protection for 315 thousand people and for property in total value of 240 billion CZK. The similar evaluation will be done after finishing construction works in phase II as well, which was prolonged for one year due to flood in 2013. [1]

Involvement and functionality of constructions for protection from floods has brought evaluation after previous flood. Constructions realized after 2002 (together 597) we repeatedly used 279 times. During last year flood 94 constructions were offended from this 79 constructions were useful, 8 of the haven´t been completed yet, but in spite of this fact they were very positive, 4 of them were crossed over by the flood and in 3 cases they fulfilled their role only partly because of technical and organizational problems.

Table 2 – Phases of programme „ Support of prevention from floods“

I.	Phase- „Beginning“ – in years 2002 - 2007	4,1 bil CZK
II.	Phase – „Development“ – in years 2007 - 2014	11 bil CZK
III.	Phase – „Retention“ – in years 20014 - 2019	started (so far 4,5 bil CZK)

Source: Ministry of Agriculture of the Czech Republic, water

3 THE PROGRAMME FOR REMOVING OF FLOOD DAMAGES

From the total value of flood damages the damage concerning water dams, river beds, rivers and water management infrastructure was 11 %. These damages are necessary to repair as soon as possible, because they could be the reason for deterioration of possible next flood.

That´s why Ministry of Agriculture has a programme, where are allocated amounts from the state budget after certain floods for sanation of risen damages. The height of subsidies is between 60 – 80 % of damage given in statement of special committee.

According to estimation of investment into technical measure, which was made by „Povodí“ in 2006 is clear that for improvement of flood protection in our area is needed about 50 billion

CZK. Nowadays about half of this amount was covered when we take into consideration all invested funds not only in programmes of Ministry of Agriculture but also Ministry of Environment, Regions, water managers of rivers and municipalities. I tis supposed that in next 12 years (till 2027) the rest part of amount should be covered.

The phase III of programme „Support of prevention from floods“ of Ministry of Agriculture (till 2019) will be focused first of all for increasing accumulation and retention of water during floods. It is necessary to mention that realization of these measures is extremely complicated by proprietary settling up of lands from private owners necessary for realization. Even though it concerns the constructions and objects in public interest (to protection of lives of the citizens in threatened areas), there is no success in acceleration of construction, but quite often the realization isn´t done and one its tool is to implement these constructions into Principles of territorial development of the region and afterwards enforced implementation into municipalities territorial plans. From this point of view such enforcement fails and it even leads to critique of decisions of regional authorities.

In agreement with „ flood regulation“ of European Union (2007/60/ES) maps of flood danger and maps of flood risks for the area were done in term 31. 10. 2013 and also maps for areas with important flood risk in the area of the whole Czech Republic. They are published in Central data store, whose purchaser is Ministry of Environment at the address: http://hydro.chmi.cz/cds. Obtaining of flood danger maps and flood risks was co-financed from the funds of Operating programme of Ministry of Environment and State fund of Ministry of Environment. They are the basis for working out the plans for managing flood risks, which will be approved till 22. 12. 2015 by the Czech government and for their realization will be possible to use prepared Operating programme of Ministry of Environment 2014 – 2020. [1]

CONCLUSION

Shortly given facts show us how extremely the prevention of floods in the Czech Republic has been improved since the first catastrophic flood in 1997. The course of flood in 2013 it practically confirmed, when despite its range the level of damage wasn´t so high and the security works were very useful, first of all thanks to readiness and equipment of fire brigades (both professional and voluntary) and also thanks to experience of State Administration. The primary role of weather forecast and wide spreading of information for controlling flood activities and security works has been confirmed. It is pleasant that many European countries take experience of the Czech Republic into consideration and it is common for our authority officers and employees of water management companies and research institutes being invited to international conferences or to consultations.

In conclusion it is suitable to emphasize the principle: The period after flood is a period before another flood – and it necessary to use it for improvement of preparations and protection because it is a natural phenomenon whose existence can´t be influenced.

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TRANSPORT AND THE ENVIRONMENT - CITY LOGISTICS PIPELINE TRANSPORTATION

DOPRAVA A ŽIVOTNÍ PROSTŘEDÍ - CITY LOGISTIKA POTRUBNÍ DOPRAVOU

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Abstract

A person throughout life, go to work to earn money to meet their needs. There are few individuals who are loyal to one job in one place. Most people are migrating for work where there is more supply. A larger supply of labor in the cities and its surroundings. Cities are growing without a deeper conception of the transport supply. The biggest problem of cities is minimal temporal and spatial regulation of supply flows. Today's solution is a compromise between the requirements of time, quantity and space-saving supplies that are only minimally affected in a competitive environment. Supply routes overwhelm a large number of vehicles that have an impact on the environment. Overload roadways causing a collision between passenger and freight land transportation.

Abstrakt

Člověk během života chodí do práce, aby vydělal peníze pro uspokojení svých potřeb. Je málo jedinců, kteří jsou věrní jednomu zaměstnání na jednom místě. Většina lidí se za prací stěhuje tam, kde je větší nabídka. Větší nabídka práce je ve městech a jeho nejbližším okolí. Města se rozrůstají bez hlubší koncepce dopravního zásobování. Největším problémem měst je minimální časové a prostorové usměrňování zásobovacích toků. Dnešní řešení spočívá v kompromisu mezi časovými požadavky, množstvím a prostorovými nároky zásobování, které lze jen minimálně ovlivnit při konkurenčním prostředí. Zásobovací cesty zahlcuje velké množství dopravních prostředků, které mají vliv na životní prostředí. Přetížení dopravních cest způsobuje kolize mezi osobní a nákladní pozemní dopravou.

Keywords

city logistics, pipeline transport

Klíčová slova

city logistika, potrubní doprava

INTRODUCTION

Today's time brings a great deal of constant change. Workflows are constantly evolving and improving, and technological procedures are introduced to increase the efficiency of production, distribution, and disposal of used goods. Every business tries to use new knowledge to achieve maximum efficiency or maximum profit. This is closely connected with the use of the maximum potential of each employee and the pooling of all available production capacities under one roof, where all branches of the enterprise are in one place. The maximum utilization of the employee's potential increases the physical and psychological fatigue that the employees are resolving for as long as possible and working at the last moment before the start of their

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work. When grouping all the available capacities of a manufacturing enterprise at one place, the enterprise keeps track of good transport service. Good transport service means placing all plants in a place where road and rail transport is developed and also air and water transport within a certain distance. The most developed transport services are in cities, their neighborhood or in urban areas (where several cities are located within a few kilometers).

In order to avoid the collapse of transport services in these cities, different types of integrated transport systems and urban mass transport are being developed for the transport of employees, but the collection of material into the company and the distribution of finished products from the company is left to the company itself. This results in travel to and from traffic jams. An effective solution for the elimination of traffic collisions and smooth supply is the adoption of logistics and, in the case of urban or city logistics cities.

Logistics is a scientific discipline that focuses on planning, managing and monitoring the flow of material, people, information and energy in a given system, focusing on minimizing costs and maximizing time savings.

1 WHAT IS CITY LOGISTICS

City logistics focuses on research and the subsequent solution of the logistics system of cities and their surrounding areas with a view to optimizing traffic flows of persons and goods. In passenger transport, it optimizes the flows of passengers in the catchment area of the city in the form of urban mass transport or integrated transport system. When transporting goods (supplying shops and businesses), cities themselves are making minimal efforts to solve the congestion of transport infrastructure. City Logistics offers various applications to solve the transport of goods in cities, irrespective of the size of the city's territory. The basic principle is the use of goods pooling for delivery and delivery, the finding of the most suitable type of vehicle for city driving and the subsequent optimization of each ride, where economic efficiency is achieved with the minimal environmental burden.

The logistics of the city and its catchment area are hindered by various limitations in the form of laws and decrees, the proper construction and the technical arrangement of the roads. These constraints subsequently accumulate excessively the means of transport into the traffic streams in mutually exclusive directions, which leads to constant traffic collisions. These collisions concern passenger and freight traffic in pedestrian traffic. The technical arrangement of the roads hits the impossibility of extending a narrow network of streets, especially in older urban areas. The throughput is low and is not sufficient for the current traffic. Nor will this issue be solved by various urban regulatory measures that try to separate or dampen conflicting components. Urban regulation of transport systems concerns time and space. Time control measures mainly concern freight transport, which is limited to nighttime movement and handling or is totally forbidden. Spatial regulation measures focus on setting up pedestrian zones, lane lanes for urban public transport, and construction of underground or aboveground parking spaces.

In general, good law is also good. The following are the fundamental rights of every human being living in the Czech Republic. Each person should be able to get basic necessities in their immediate vicinity in so-called walking distances. If a person is forced to make a long way to buy goods or to meet their social and health needs, he or she has the right to have a transport system that can achieve this.

In passenger transport, the definition says: "basic transport services as the general right of a citizen to establish that a citizen has the right to place his / her place of employment, pupils and

students, the place of the appropriate school, the places where the relevant health care is provided and the offices, Within the competence of which the citizen belongs, by public transport of a statutory quality ".

In freight transport, there is no definition of basic transport service, and it is also an important part of ensuring human life.

Both concepts of basic transport services by passenger and freight transport are included in the definitions of citizens' rights and freedoms in European Community Regulations (Council Regulation (EEC) No 1191/69 on action by Member States concerning public service obligations in respect of transport by rail, road and inland waterway Wording of Council Regulation 1893/91).

City logistics must be understood as a unified integrated logistics system, which includes public passenger transport, transport of goods and materials, sorting and forwarding of individual consignments and operation of the internal transport system, warehousing and follow-on sales network, transport services for small and medium-sized enterprises The input is transported to the work process, the material is weighed into the production process and the output is the production of finished products, its basic transport service in the form of distribution to the shops for goods categorized according to transport services. Representatives of every city must realize that if they want to have fully functional logistics on their territory, they must force all carriers to cooperate with clearly defined conditions where competitive struggles are forbidden. The building of functional city logistics in the city and its catchment area can not be based solely on the commercial principle of economic efficiency, as no logistics operator would be able to serve all business units regardless of the amount of profit or loss. Also, it is not possible to carry out logistics by the entrepreneurs themselves, because the reimbursement of all the costs associated with the operation of the logistics center is not in their economic power. A simple recipe for this situation is the focus on building a city supply center under the patronage of the city, with the support of a grant from the European Union. The city as a patron of the entire logistics system would ensure the running of a city center, an equitable approach for all freight carriers (small and large) and all the logistics operations in their territory according to a defined supply schedule called logistics control.

Logistics control is used to ensure and eliminate possible shortcomings in city logistics. It helps maintain the desired state by following the individual linguistic processes, applies feedback for control, and subsequently adjusts the system for further operation. It also ensures the security of the permanent control of the economy by comparing the plan with reality and highlighting the possible undesirable development of the supply situation. For a predetermined period, he monitors logistics performance and costs. Logistics control also serves as a record system. A perfect logging system is a prerequisite for successful planning and management of logistics processes. The system of records has the task of constantly monitoring and reporting all necessary data on individual costs and performance. The logging system must have firmly defined logistical processes, a logistical cost classification, and appropriate indicators.

2 PUBLIC LOGISTICS CENTER

The Public Logistics Center integrates transport and freight forwarding companies, logistics service providers, customs administrations, industrial and commercial enterprises with their logistics requirements, leasing, insurance and banking companies. It uses at least two modes of transport (railway - road) to realize transport requirements. The Public Logistics Center is designed to deepen and manage mutual cooperation between business entities. The division of

technological and working processes and processes in industry and trade requires modern and constantly evolving logistics structures. Integration into a public logistics center is an opportunity for each enterprise to meet new market demands in cooperation with "competitive" partners. The public logistics center is a nodal point in which transport modes of transport mix together. It offers optimal conditions for the creation of combined transport chains (road - railway). Placement at the combined transport terminal can be achieved in the long run by increasing the performance of rail transport. The public logistics center, by effectively managing transport activities, reduces the burden on transport infrastructure and directs goods to more environmentally friendly means of transport and also adapts infrastructure to anticipated market demands. The benefits of a logistics center should not be evaluated as just one point in the region but interconnection with other public logistics centers and working together must be achieved. The cooperation of public logistics centers will thus support the efficiency of the circulation of transport units in the territory of the city, region, the republic.

3 THE CONCEPT OF BASIC LOGISTIC SERVICEABILITY OF THE CITY AND ITS CATCHMENT AREA

Logistics as a science branch offers two logistics solutions to city logistics solutions. The first is Hub and Spoke and the other is GATEWAY.

The Hub and Spoke logistics technology is based on the existence of a single logistics center (hub = center, core) from which the city's spokesman (spoke = line, beam) is operated. This name must be taken symbolically because the logistics center is always outside the city asymmetrically with respect to the center. This technology assumes the need to supply the city (household, small and medium-sized enterprises) with material, raw materials and goods. At the same time, it is also assumed that the generated products will be removed, taking into account the waste from production, trade and consumption of households. Conversely, large service centers are not expected to operate because they usually have their own enterprise logistics system, or their own supply logistics deal with outsourcing.

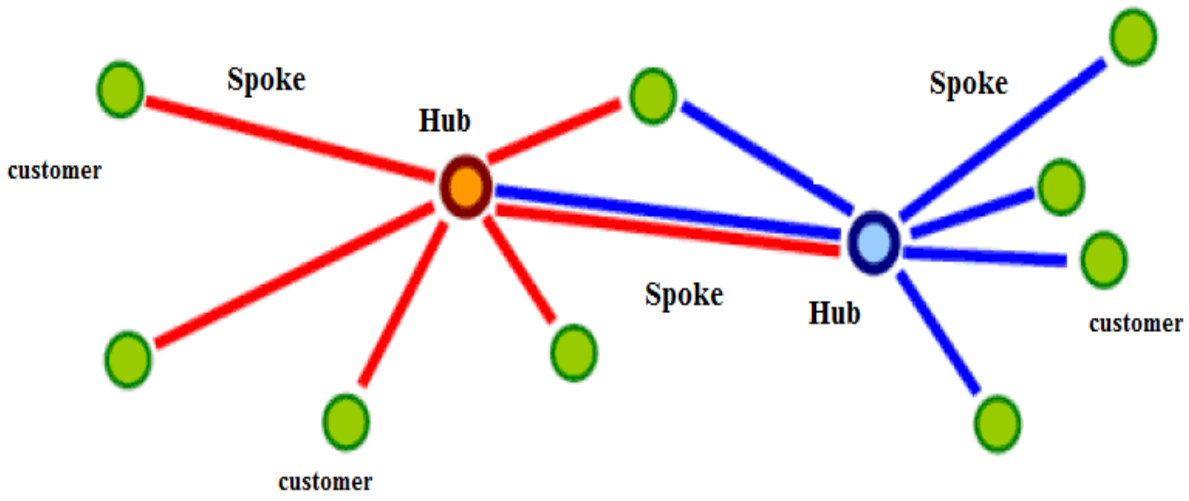

Fig. 1 Hub and Spoke
Source: [1]

Hub and Spoke technology operates with two traffic circuits:

- the external transport system whereby the commodities transported (usually in large grouped consignments designated to one or more recipients) enter the service area (urban agglomeration, souměstí) or, on the contrary, the consignments at the logistics center stand out,
- the internal transport circuit which ensures delivery of split shipments from the logistics center to the territory or, on the other hand, binds to the logistics center the production from the urban agglomeration, where it creates routed consignments.

External transport is provided by high-capacity transport systems, or a combination of them (multimodal transport system). The most common are rail, river or naval transport. Inland transport is limited by the state of transport infrastructure due to the mode of transport and the means of transport. Frequent road transport is carried out by vehicles with a payload of 3.5-6 tonnes.

The centerpiece of technology is a logistics center that is equipped with:

- by connecting to the transport infrastructure of the internal and external transport system,
- equipment for the handling, distribution and association of consignments,
- packaging equipment (palletizing, palletizing, etc.).

The goal of the logistics center is not to store materials and products. If materials and products are stored in the center, then in order to create a directionally consolidated consignment, or at the customer's order. This makes the logistics center different from centralized warehouses or specialized logistics companies providing logistics outsourcing.

The Gateway logistics technology is suited for the logistics transport of large urban centers. On the outskirts of the city, Gateways, which are a function of logistics centers in the

Hub over Spoke technology, are built on the transport routes. Here are two situations:

- from one of the gates operated by the entire city center means that respect the defined traffic restrictions of the given urban territory (eg excluding freight transport at certain time intervals of the day, limiting the vehicle mass category, handling of pedestrian customers) so-called one-stage operation.
- if the territory of the city center is very large and the traffic constraints in different parts differ, then the variant of the so-called two-stage operation is applied.

If a large shipment, intended for multiple recipients scattered across the city, enters the gate, the sorting is done as follows:

- for a particular recipient, the classification will be made only for the circuit closest to the gateway,
- for other recipients, a directional classification is determined for second-class gateways that are appropriately spaced in the inner part of the city and then the customer service is performed. This reduces the burden on urban roads, because the interconnection between the first and the second level gates is done at a suitable time (outside the peak hours, for example by night attendants). The advantage is the possibility to use more massive means of transport, or also rail transport. The disadvantage is longer transport time.

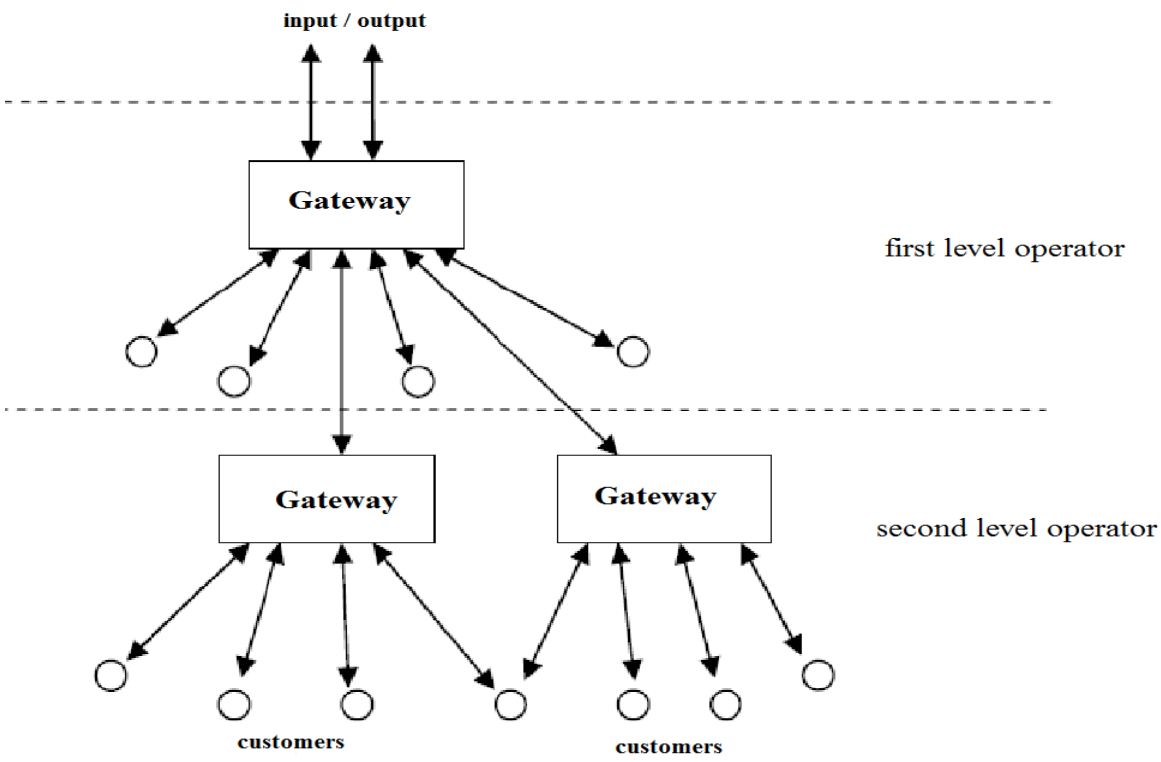

Fig. 2 Gateway
Source: [1]

There is no combination of Hub technologies over Spoke and Gateway in cities and its catchment area of the first category or of the second category. An important part of both concepts of total traffic is the connection to security information technology, which must be programmed to the right extent and accessible to customers as a parcel tracking interface. That is why it is necessary to integrate also the transport telematics systems, which are able to reduce the traffic congestion at any point (optimization of the flow of goods by the supply system) and to increase the distribution of current information on the movement and condition of the goods (elimination of supply of trades from non-public logistics warehouses serving for one enterprise).

4 WHAT IS PIPELINE TRANSPORTATION

Pipeline transport is designed for the transport of liquids, gases and solid materials. The source of energy for transport is the gravitational force and the pressure differences in the pipeline and beyond. With pipeline transportation, each of us meets daily at home, for example, bathing, flushing toilet and heating the house. The water is used through the pipeline (water main) and the wastewater is also drained through the pipeline (sewerage). The heating of the house is also used for pipelines where hot steam or water is led by hot water, or gas pipelines are fed with natural gas to the gas boiler. Pipeline transport ensures the transport of raw materials both short distances (sewerage) and long distances (pipeline, gas pipeline). The transport of solid materials and goods is by pipeline transport carried out in the form of pipeline mail or as an express delivery of blood plasma in hospitals. Large-scale piping systems are today at the stage of exploring and developing the means of transport and the network in which they will move.

Tab. 1 Benefits and disadvantages of pipeline transport

Advantages	**Disadvantages**
Bulk transport at 15 m / s	Relatively small transport speed
Availability of resources and outlets	Restrictions on a certain shipping relationship
Independence of natural and other conditions	Limited ability to increase permissive performance
Possibility of central control via remote control	The existence of long-term stable transport requirements is necessary
Ability to integrate into the combined transport system	High cost of pipeline system construction
High degree of mechanization and automation of transport technologies	Insufficient use means long-term returns
Possibility of interconnection and collaboration of multiple systems	The problem of construction on private land
Low noise and dustiness	
Reduced risk of contamination	
Low maintenance costs in trouble-free condition	
Organic transport	
Continuous operation - high efficiency	
Negligible losses of transported goods	
Direct, shortest direction of transport	
Simple and operative management	
Underground storage	
Low variable costs - staff salaries	
Security and reliability of the supply of goods	

Source: own

The following screenshots will show us one possible option for city pipeline delivery solutions. This is an underground pipeline project designed to solve problems with insufficient capacity of transport routes in the densely built area of Poruri in Germany. The German company CargoCap, in cooperation with the University of Bochum, addresses the problem with a special tunnel for transport units in continuous sequence. Goods transport is carried out by individually driven units called Caps. These units are designed to carry two loaded europallets at a speed of approximately 40 km / h.

Fig 3 Motion of capsules regardless of urban traffic, Source: [2]

Fig 4 Transport of two pallets to the customer, Source: [2]

Fig 5 Automatic mail order sorting (trade)

Source: [2]

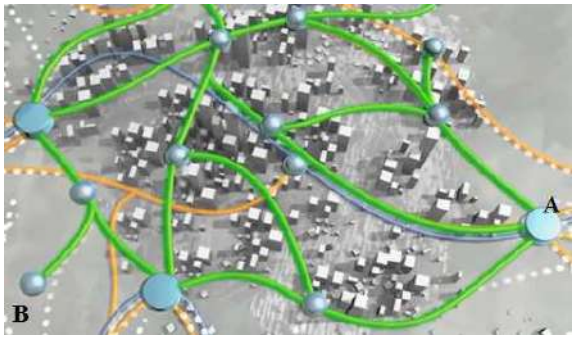

Fig 6 Transport from GATEWAY (A) to Customer (B)

Source: [2]

This pipeline model outlines a possible solution to the future supply of the city, which is very environmentally friendly. Pipeline transport can solve the current malfunctions of the last article of the logistics process, where goods are distributed on the so-called last mile. The last mile is the stretch of the way the goods are delivered to the store not directly to the door of the house. The construction of pipeline transport for the needs of the city must be understood as the strategic intention of the city to take care of its inhabitants in the most efficient way for which the return on investment is not within days or months.

CONCLUSION

One can only hope that each city will realize how important pipeline transportation is for its own development, and city logistics is an effective tool to meet its own needs. All scheduling on the supply of goods is a long-running run and can not be done through regulation, restriction or prohibition. This would put the city in a dead end and give the impression of relocating to a better and more comfortable way of life.

By understanding city logistics and putting it into a real functional unit, the city will eliminate the inefficient spatial and time flows of goods. City logistics through the above can reduce the waiting times for unloading merchandise, eliminates empty transport vehicles to a minimum, can deliver higher load and ride density with the exact amount required. Using pipeline transport and these technologies will result in the consolidation and streamlining of goods flows with minimal impact on the environment. The city's clear goal in city logistics must be to connect as many transport requirements as possible to a managed system that suits the needs of sellers (shoppers) and buyers (a person living in the city).

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ANALYSIS OF MOBILITY WORKFORCE IN THE REGION

ANALÝZA MOBILITY PRACOVNÍ SÍLY V REGIONU

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Abstract

The aim of this paper is to present the methodology and outcomes of the case studies for the company MUBEA. It was one of a series of practical cooperation of the local company with College of Logistics. Currently the main topic of the project was region's labor force and mobility. The contribution specifies the goals, the methodology itself and the fulfillment of these goals which is presented on map outputs. In the conclusion of the paper, further steps of cooperation in this area of interest are outlined.

Abstrakt

Cílem tohoto příspěvku je seznámit čtenáře s metodikou a výstupy případové studie pro firmu MUBEA. Jednalo se o další z celé řady praktických spoluprací místního podniku s Vysokou školou logistiky. Tentokráte bylo hlavním tématem projektu pracovní síla regionu a její mobilita. V příspěvku jsou zmíněny stanovené cíle, vlastní metodika a plnění těchto cílů, které je prezentováno na mapových výstupech. V závěru příspěvku jsou nastíněny další kroky spolupráce v této oblasti zájmu.

Key words

Mobility, labor, logistics, commuting, commuting costs

Klíčová slova

Mobilita, pracovní síla, logistika, dojížďka zaměstnanců, náklady dojížďky

INTRODUCTION

Low labor mobility reduces the efficiency of the labor market and hampers economic growth. Growth in labor mobility is, in addition to ensuring an appropriate education and

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qualifications structure of the labor market, considered to be an important condition for ensuring the needs of businesses in increasing their performance and competitiveness. At the current stage of re-launching the growth of industrial production and the related need to attract new workers, the urgency to seek concrete ways to address the discrepancy between localization of potential labor resources and localization of businesses is growing.

MUBEA supplies its products to automobile manufacturers around the world (Audi, BMW, Chrysler, Daimler, Ferrari, etc.). It develops its products in close cooperation with its customers. The MUBEA is exceptional in lightweight design, friction reduction and reduced built-in space, including gearbox springs, engine springs, axle springs, stabilizers, carbon fiber reinforced products or car interior components. [3].

It follows from the above that the success of a company depends on the performance of its employees. MUBEA is constantly investing in the education of its employees at all levels of development, production and management [3]. The company itself has created more than 5,000 new jobs throughout the world over the last six years. The exception is therefore not looking for new employees to the branch in Prostějov.

OBJECTIVES OF THE CASE STUDY

MUBEA's management has addressed the College of Logistics with a request for cooperation in the field of labor mobility analysis in Prostějov and the surrounding area. As MUBEA plans to expand its production, it also needs to provide adequate workforce at all levels, especially looking for new employees in the workers' professions.

The purpose of the case study was to assess the resources and geographic distribution of the potential working (especially labor) power in the region. Design accessibility by mass passenger transport in the nearby and further distant surroundings of Prostějov. And formulate measures and conditions that will lead to the use of the labor force for active employment in areas with limited mobility.

METHODOLOGY OF THE CASE STUDY

Since the previous survey on a similar topic was unknown, the methodology had to be based on basic, often general, source data. From the point of view of MUBEA, it was mainly the organization of shifts and qualitative and quantitative criteria for the selection of new workers. From the point of view of labor resources, there was the data on the number and structure of the inhabitants in the area of interest (Czech Statistical Office) and the unemployment rate in the area of interest (individual labor offices). Population availability was assessed on the basis of information collected from the public internet timetable IDOS.

It was necessary to supplement the mass transport of an individual car. According to studies [Professions], 73% of employees are willing to commute 30 minutes by car to work or 60 minutes by mass passenger transport at an adequate level of salary, position or transport allowance. On the basis of real time accessibility of a maximum of 30 minutes by car, the boundaries were defined and the municipalities of the area concerned were allocated. The selection was made using the ArcGIS program and the communications layer from the ArcČR database where each average road speed and motorway were assigned

an average speed value, e.g. for highways and speedways 110 km/h, roads of I class 70 km/hour. Based on the length, the time was assigned to individual sections of the communication. Gradual loading of the time values up to 30 minutes created a time model of commuting by car to Prostějov. The total number of the surveyed municipalities (cadastral territories) has stabilized to 348. The results of the analysis are clearly illustrated in Figure 1. In terms of mass transport, there was a decision after the discussion with the case study commissioner on the maximum commute of 120 minutes and three transfers, the approach must have been at least 20 minutes before commencement of the shift, and the maximum wait for the jump after the shift was 50 minutes.

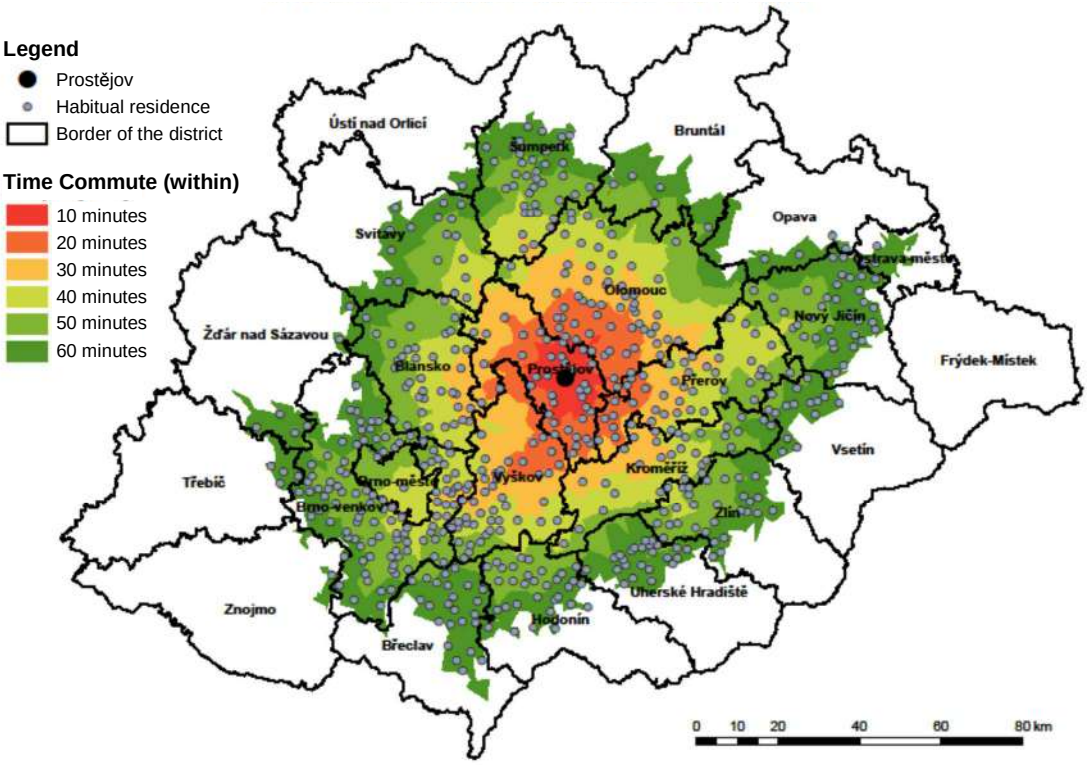

Fig. 1 Municipalities of the area of interest
Source: own processing, map background [1]

The potential source of new employees was adjusted by the combination and comparison of the economically active population, registered at labor offices, who are immediately available for employment, trained in the technical field or who have completed a secondary school with a GCSE. Data were provided by the Labor Offices in Přerov, Prostějov, Šumperk, Olomouc, Jeseník, Zlín and Blansko districts as of April 30, 2015. The data comes from GIS2 statistics, the structure according to education includes the UCVE, UCVH, UCVJ and UCVL groups according to statistics and Categorization of the Ministry of Education of Youth and Physical Education and the Ministry of Labor and Social Affairs.

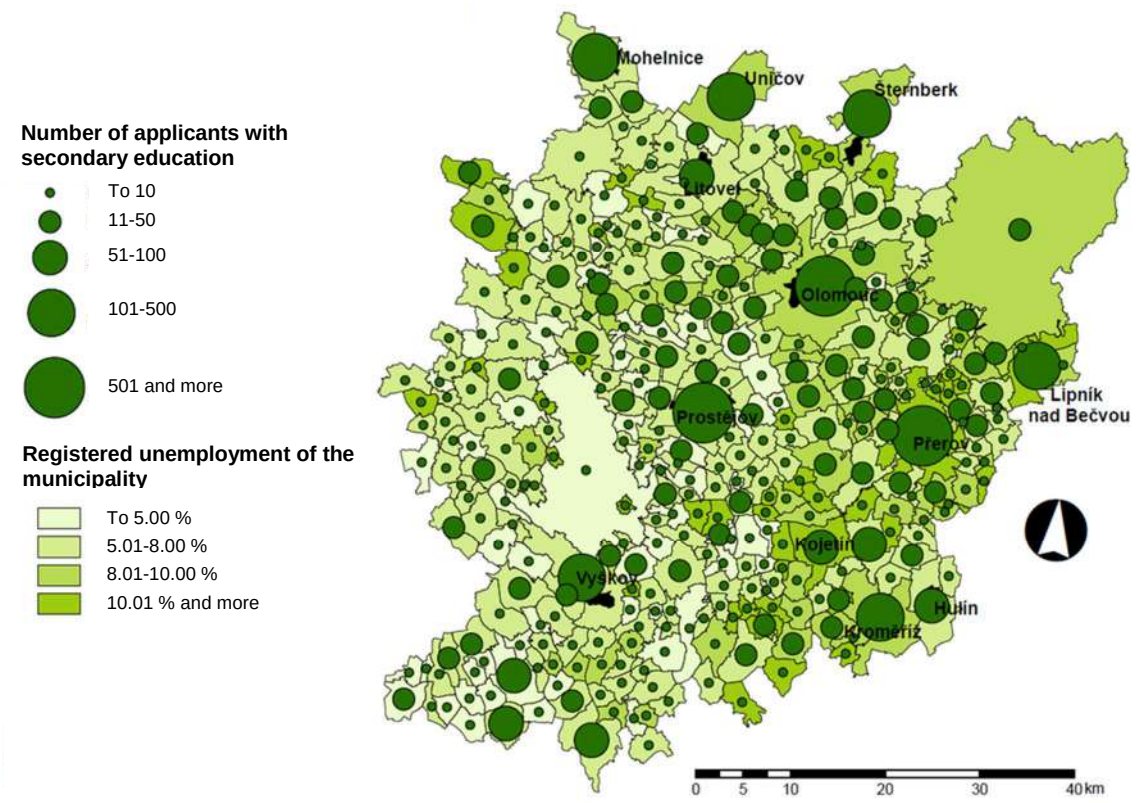

Fig. 2 Number of job seekers (unemployed) with the required education
Source: own processing, [4], map background [1]

Another monitored aspect of municipalities in the area of interest was accessibility. Of all 348 villages surveyed, using a passenger car can be transported to Prostějov within 30 minutes. Using search engines for all types of public transport - bus, train - verified accessibility of monitored municipalities for individual shifts. The exchanges were given by the company's requirements.

Under the specified conditions, see above, a database of all municipalities was created for each shift, indicating whether or not shift and shift is possible. From these databases, map outputs of commuting to individual shifts (0 - unavailability, 1 - availability in one direction, 2 - availability in both directions) were created. For three-shift and continuous operation, a composite commute analysis was created from individual shift outputs. For every municipality there is a number of all commuter commutes, graphical depiction of the number of inhabitants of individual municipalities with secondary education. For all three shifts in the three-shift operation, it is possible to identify a maximum of 6 routes (from/to the shift), for eight consecutive operations (day, night and weekday and holiday, again from/to the shift).

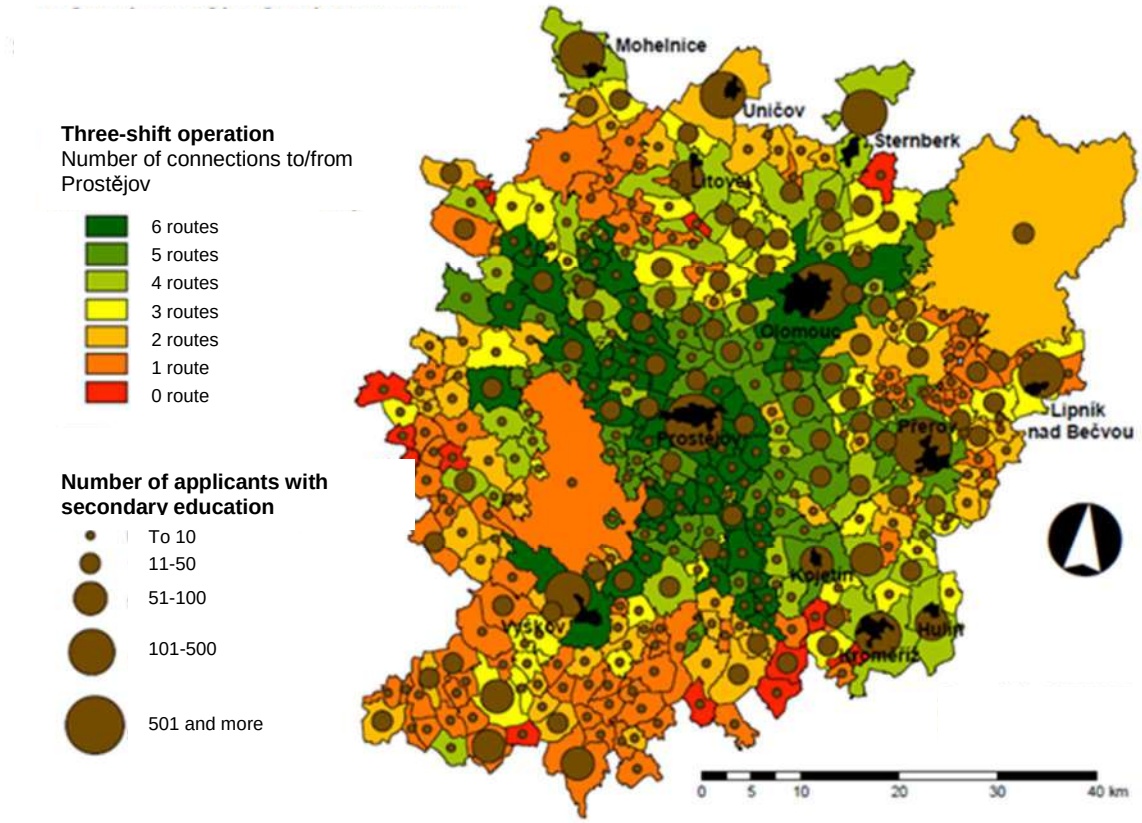

Fig. 3 The number of journeys on all shifts within a three-shift operation, complete with the number of unemployed with secondary education
Source: own processing, [2, 4], map background [1]

THE CASE STUDY OUTPUTS

From the obtained data we conclude, there is a frequent discrepancy between settlements with available staff and transport services. The transport availability statistics shown in Tab. 1 shows that only 38 % of job-seekers with secondary education from the area of interest are guaranteed access to all exchanges. An increase in the number of connections by 1-2 would make the commuter available for some 38 % of the applicants. On the contrary, in a number of municipalities the service is suitable for the enterprise.

Tab. 1 Number of available job seekers and their availability

	Available job seekers aged 15-64	**Applicants with secondary education**
Total in the area of interest	30638	7347
With great availability for 3 shifts (6/6)	10499	2780
With good availability for 3 shifts (4-5/6)	11595	2660
With bad availability for 3 shifts (2-3/6)	5500	1264
With no availability for 3 shifts (1-0/6)	3044	643

Source: own processing, [2, 4]

With using of the obtained outputs, municipalities were identified to consider increasing the number of connections to improve the availability of potential staff for MUBEA. The selection of municipalities is shown in Figure 4 using the hatched area. These are **Konicko**, **Nezamyslice**, **Přerov - Olomouc** and **Kojetín - Přerov**. Thus, areas are with high unemployment, poor accessibility and a potential source of new employees.

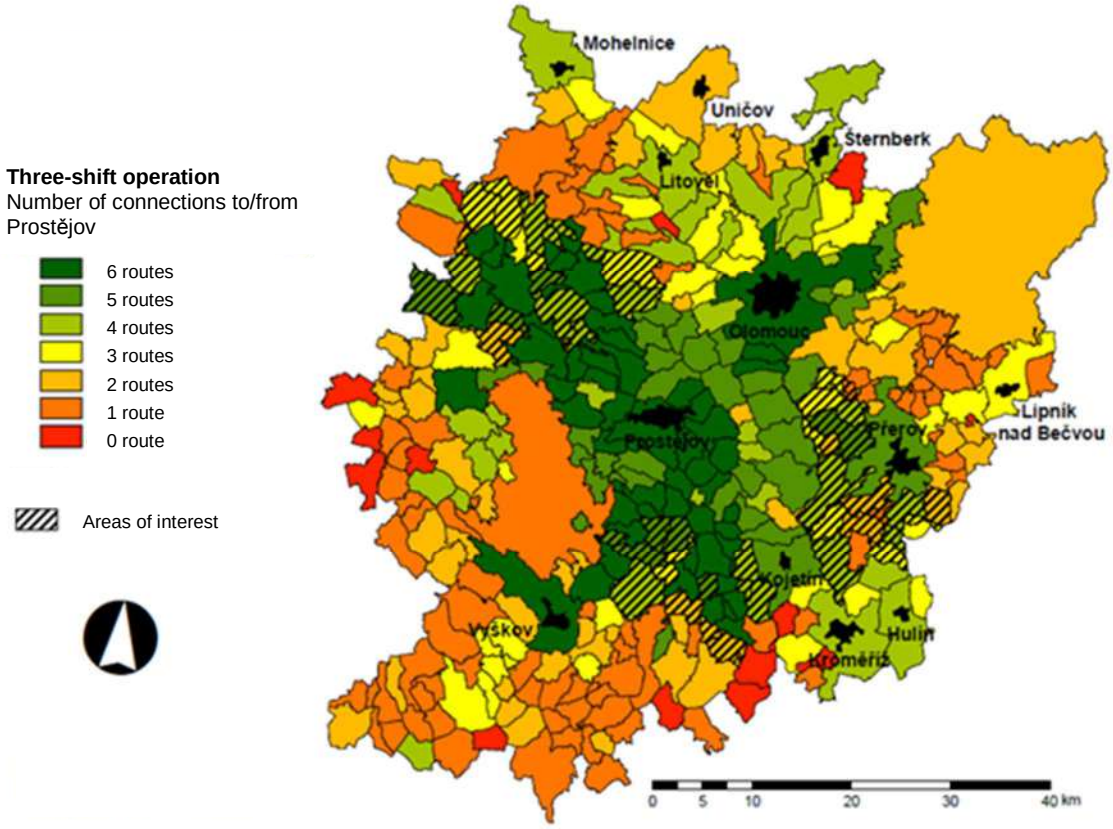

Fig. 4 Selection of municipalities to complement the number of connections for three-shift operation
Source: own processing, [2], map background [1]

Not only commuting, but also commuting costs are factors that affect jobseekers when deciding on an employer. Local communities with a high number of job seekers were selected. For these villages, the cost of transport to Prostějov was calculated for each individual ride. The basis for determining the cost of transport from selected locations for bus and rail was the transport tariffs according to the rates of the carriers, when using a passenger car, a refund scale using a passenger car for business purposes. So far, no consideration has been given to the situation where an employee would use his own vehicle without the need to reimburse travel expenses.

As an example of the proposed changes, the municipality of Majetín, with a potential for secondary school graduates of 11 employees and 20 commuters (without rebates), could be worth CZK 1880 per month. The completion of the four connections for the Kojetín - Prostějov connection would make access to all exchanges available for a total of 72 job seekers with the required education, the commuting time would be 39 minutes in one direction, and the monthly commuting costs for 20 shifts would be CZK 1120 without discounts.

The following table shows the comparison of individual car traffic with mass bus and rail transport in the areas of interest.

Tab. 2 Comparison of modes of transport in selected areas of interest area

	Individual car transport			**Bus transport**			**Rail transport**		
	Distance[km]	Transportation time [min]	**Transportation costs [CZK]**	Distance[km]	Transportation time [min]	**Transportation costs [CZK]**	Distance[km]	Transportation time [min]	**Transportation costs [CZK]**
Olomouc - Přerov	19,7	22,3	**72,8**	34,2	63,2	**34,3**	37,8	37	**53,5**
Vyškov - Kojetín	20,3	25,8	**75,2**	26,1	46,4	**30,1**	26,4	32,8	**46,8**
Kojetín - Přerov	27	34,9	**100**	40,2	74,6	**44,3**	40,2	61,2	**64,5**
Konice - Litovel	26,2	38,3	**96,9**	30,8	61,6	**32,1**	27,6	50,8	**46,2**

Source: own processing, [2]

The advantages and disadvantages of four variants of the general solutions also presented to MUBEA and are listed in the following table.

Tab. 3 Comparison of selected mobility solutions for employees

Variant	**Advantages**	**Disadvantages**
V1:external transporters	Costs for the company (subject to statutory conditions)	Selection procedure ⇒ **costs increase**
V2: internal transport	The vehicle can be used as an advertisement carrier	Managed by the company: leasing, operation (fuel, driver, traffic, insurance, etc.) ⇒ **costs increase**
V3: additional cost of transport from public sources	Only for selected areas with commute over 10 km, validity 6 months, up to 2.50 CZK/km, only one way (there, not back))	The issue of sustainability
V4: additional cost paid by the company	E.g. 1000, - CZK costs the company 1340, - the worker gets about 740, -	The need to determine the amount of the supplement and the number of workers covered by the measure ⇒ **costs increase**

Source: own processing

CONCLUSION

The current distribution of job opportunities is uneven and it corresponds to a substantial extent to the distribution of unemployment. The current transport infrastructure respects the needs of the necessary public transport services, but not the employment needs, especially of the non-stop operating companies. The remote availability of potential workers from the seat of a potential employer thus encounters an obstacle that can be solved both in the employer's interest and in society's interest.

Part of the project was in the original version also drafting proposals for eventual changes in timetables or introducing staff transport. This can only be done if workers are recruited in defined areas. Only then it is possible to enter into negotiations with carriers, or process costing own transport. The effectiveness of these measures depends strongly on the number of persons transported. It would be better to set up the right marketing strategy in each region and work with local government and local authorities.

Map outputs (Fig. 1-4) are not completely according to cartographic markings. They were created at the request of the contracting authority.

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ENVIRONMENTAL ACTIVITIES IN WASTE MANAGEMENT OF MUNICIPALITIES

VYBRANÉ ENVIRONMENTÁLNÍ AKTIVITY V ODPADOVÉM HOSPODÁŘSTVÍ OBCÍ

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Abstract

Questions of the environment are very actual. Companies make steps to be differentiated e.g. by certifications, to shows that they are not indifferent to the environment. People cannot be certified the same way as companies can, still people's impact on the environment is substantial. Municipalities are obliged to treat waste that people produce, at the same time people often have no possibility to influence the way of the waste treatment. Environmental management accounting or similar environmental activities applied in waste management can help to optimize the system and find hidden environmental costs and benefits. Data connection of financial and management accounting in local agenda can answer lots of questions.

Abstrakt

Otázky životního prostředí jsou velice aktuální. Podniky se před svou konkurencí odlišují mj. i tím, že svému okolí ukazují, že přístup k životnímu prostředí pro ně není lhostejný. Obyvatele nelze certifikovat tak, jako výrobní podniky, přesto vliv každého člověka na stav okolní přírody je nezanedbatelný. Jsou to obce, které likvidují lidmi vyprodukovaný odpad jako vlastní, přitom obyvatelé často nemají možnost způsob nakládání s odpady v obci ovlivnit. Environmentální manažerské účetnictví nebo podobné environmentální aktivity aplikované na oblast odpadového hospodářství můžou vyplnit prostor při optimalizaci systému a pomoci nalézt skryté environmentální náklady a výnosy. Propojení dat z finančního a manažerského účetnictví v obecní agendě může přinést odpovědi na mnoho otázek.

Key words

waste management, environmental management accounting, ecological footprint, Local Agenda 21, EMAS

Klíčová slova

odpadové hospodářství, environmentální manažerské účetnictví, ekologická stopa, Místní agenda 21, EMAS

INTRODUCTION

Waste management is a developing discipline attracting deserving attention. Many experts or laymen on all levels deal with this topics. There are many studies and projects of the Ministry of the Environment of the Czech Republic, also many other institutions try to solve the questions of the environment. Then there are many initiatives, associations or joint municipalities dealing with the task – what to do with waste and how much does it cost.

Experts of the environmental departments agree, that attitudes as Environmental Management Accounting (EMA), Local Agenda 21 (LA 21) or ecological footprint can be useful tools in environmental questions, specifically within waste management. Efficient setting of the system of waste management could help to find hidden reserves in cost. Public sector is trying successfully to implement different methods or techniques form business regarding monitoring and managing environment issues.

The article aims at the possibilities of environmental activities in municipalities, especially at EMA, that is already applied abroad.

1 ENVIRONMENTAL ACTIVITIES IN A MUNICIPALITY

Waste treatment is a legal duty of municipalities, and is considered as a service necessary for residents life. The municipality is considered as waste producer since residents lay waste in given places. The municipality is then an owner of waste and has a duty to treat waste according to the law No. 185/2001 Sb.

The aim of public administration is according to Půček (2005) "to increase the quality of live of residents together with respecting the rules of sustainable development, and to increase the performance and quality of public services". The aim reflects the principles of so called "good governance", that was introduced by the UN in 2000 (Soukopová, 2015).

Půček (2005) in the chapter about the environment mentions topics leading to the satisfaction survey:

- quality systems and respect for nature according to **ISO 9001** and **ISO 14001** at municipal companies,
- Balanced Scorecard method applied in municipalities, regions and at strategic planning.

Eco-Management and Audit Scheme (EMAS) motivates the organisations positively to the responsible access and improving environmental performance beyond the framework of legal requirements (Cenia, 2012). It was created by the EU in order to identify and monitor companies' impact on the environment and to publish information through Environmental Statement.

One of the differences between EMAS and ISO 14001 is according to Hájek (2011) in the focus in "*indirect environmental aspects, that are typical for public organizations (offices, financial institutions etc.)*".

There are 27 subjects in the Czech Republic registered in EMAS database. Four of them are public institutions, specifically:

- Chrudim Municipality,

- Jilemnice Municipality Office,
- Regional Authority of Moravskoslezský kraj,
- University Hospital u sv. Anny in Brno.

Implementation of tools for **environmental management systems** (EMS) and information change can help according to Hájek (2011) to the effective reduction of negative impacts on the environment. "*Since beginning the projects are aimed at tools and particular measurements connected with the system of environmental management, e.g. Projects of cleaner production and pollution prevention, application of the best available techniques, growing of energy efficiency, or support of methodical tools as handbooks for local government, manual EMS easily!, websites and others*."

To ensure the functional EMS system, it is necessary according to Fildán (2008) to create measurable indicators of the environmental profile of the company. The indicators must be objective, verifiable and repeatable.

Indicators of waste management are in Table 1, as Fildán (2008) introduces in his text.

Tab. 1 Indicators for waste treatment

Indicator	Unit	I. Q	...	∑ / year	Last year	Progress in %
Total production of waste	t					
Total production of waste per the production unit	t/PU					
Production of hazardous waste per production unit	t/PU					
Rate of waste recovered (inner)	%					
Rate of waste recovered (external)	%					
Costs for waste disposal	CZK					
Costs for waste disposal per production unit	CZK/PU					
Products in waste management	CZK					

Source: Fildán (2008)

Local Agenda 21 (LA 21) is often used abroad as a quality standard in the field of public relations and sustainable development (Ball, 2002; Schaltegger, Hahn and Burritt, 2001). In the Czech Republic it is introduced through the methodology of Healthy Cities of the Czech Republic. The current status of the process is shown in Table 2 (Category A – the best ones).

Tab. 2 Curretn status of LA 21 in the Czech Republic

Category	Number	Category	Number	Category	Number
category A	2	category C	45	interested	93
category B	3	category D	32	others	44

Source: Ministry of the Environment of the Czech Republic (2016)

Ecological footprint (also called green accounting) is according to TIMUR (2016) a global indicator of people's impact on the environment. It is the size of the area that is necessary for the production of resources and waste disposal that some unit (nation, state, community etc.) drawn from the nature and nature into stores to meet their needs. This is the part of demand. The offer is called bio capacity, so the sum of productive areas (e.g. arable land, forests or water bodies) that a person (city, nation) has at the disposal. When comparing the ecological footprint and bio capacity, it is possible to find out, if the given unit creates an ecological reserve or a shortage.

Table 3 compares ecological footprint, bio capacity and ecological reserve/ shortage in selected counties. The Global hectare (gha) means the sum of biologically productive dry land and water bodies at the disposal for one inhabitant of the planet.

Tab. 3 Ecological footprint, bio capacity and ecological reserve/ shortage in selected counties

	Ecological footprint per inhabitant (gha)	Bio capacity per inhabitant (gha)	Ecological reserve (+)/ shortage (-) per inhabitant (gha)
World	2,7	1,8	-0,9
USA	8,0	3,9	-4,1
China	2,2	1,0	-1,2
India	0,9	0,5	-0,4
Russia	4,4	5,8	+1,4
Japan	4,7	0,6	-4,1
Brazil	2,9	9,0	+6,1
Great Britain	4,9	1,3	-3,6
Congo	1,0	13,3	+12,3
Czech Republic	5,7	2,7	-3,0

Source: Tomšík (2016), according to Ewing et al. (2010)

Ecological footprint of the city is a complex indicator of environmental sustainability of the city. It converts sources (e.g. electricity, natural gas, gasoline, building materials, food, timber, etc.) consumed by residents and institutions of the city together with their waste, to corresponding bio productive areas. Then it is compared with bio capacity, thus sources that the city has at disposal. Twenty-four towns and one region used the calculation of this indicator in 2010-2015 in the Czech Republic.

2 ENVIRONMENTAL MANAGEMENT ACCOUNTING

Environmental accounting terminology often uses such words as ‘full’, ‘total’, ‘true’, ‘comprehensive’ and ‘life cycle’ to emphasise that conventional organisational management and accounting approaches are incomplete in scope because they overlook important environmental benefits and costs (EPA, 1995; Qian, Burritt and Monroe, 2008, 2011).

EMA can be generally defined as identification, measurements, accumulation, analysis, preparation, interpretation and communication of information about material and energy flows, information about environmental costs and other value terms information that are base for the decision making processes in company (Remtová, 2006; Farský, Ritschelová and Sidorov, 2006). The aim is to find out, how the activities linked to environmental questions are displayed in financial flows of the company. So EMA puts emphasis at accounting linked to the environmental costs.

According to Hyršlová and Vaněček (2003) EMA works with identification, accumulation, presumptions, analysis, reporting and communication of:

- informations about material and energy flows,
- informations about environmental costs,
- other value terms information that are base for the decision making process.

EMA uses two subsystems, which is not very common at the traditional management accounting. It puts side by side EMA in monetary units (MEMA) and EMA in physical units (PEMA). Non-financial aspects of the company's performance are for EMA management substantial. EMA tools specific for MEMA and PEMA, past oriented and future oriented, are summarized in Table 4.

Tab. 4 EMA tools

EMA – Environmental Management Accounting			
MEMA (Monetary Environmental Management Accounting)		PEMA (Physical Environmental Management Accounting)	
specific MEMA tools		specific PEMA tools	
past oriented	future oriented	past oriented	future oriented
• environmental costs accounting • accounting for environmental benefits	• monetary environmental budgeting • monetary environmental investment appraisal	• material accounting • energy flow accounting	• physical environmental budgeting • physical environmental investment appraisal

Source: Schaltegger, Hahn and Burritt (2001)

Tab. 5 EMA information

Physical and monetary accounting for waste and recycling activities	Hidden and external cost and impact accounting
Garbage waste - physical	*Indirect costs*
Quantity of garbage waste collected	Public waste education and outreach costs
Quantity of garbage waste incinerated	Administrative costs for waste management
Quantity of waste sent to landfill	Waste reporting and auditing costs
Garbage waste - monetary	Landfill disposal costs avoided via recycling and reduction
Garbage waste collection costs	*Future-oriented costs*
Garbage waste to energy sales revenue	Costs associated with expected closure of landfills currently being used
Garbage waste disposal costs	Expected costs of long-term post-closure, rehabilitation and monitoring of landfills currently being used
Recyclables and green waste – physical in total	Expected costs of landfill site and facility replacement
Quantity of total recyclables collected	Anticipated costs of regulatory changes
Quantity of total recyclables recovered	Anticipated remediation costs
Contamination rate of total recyclables	*Externalities*
Quantity of total green waste collected	Environmental benefits from current recycling services
Recyclables and green waste – monetary in total	Environmental impacts generated by current recycling services
Total recyclable collection costs	Economic value of resources being buried as waste in landfill
Total recyclable sorting and recovery costs	Cost associated with reducing greenhouse effects contributed by waste steams
Total recyclable sales revenue	Costs associated with controlling toxic and odorous landfill gas emissions
Total collection costs for green waste	Costs associated with landfill leachate collection and treatment for protection of ground water
Total processing costs for green waste	Costs associated with the loss of land capacity and value because of waste disposal
Integrated in total	Cost associated with the loss of amenity because of waste disposal
Cost per tone for total recyclables	
Cost per household for total recyclables	

Source: Qian, Burritt and Monroe (2011)

According to Qian, Burritt and Monroe (2011), methods of full costs and life cycle method were developed since 90. of 20th century, in order the ‘full’, ‘total’, ‘true’, ‘comprehensive’ and ‘life cycle’ costs, together with cost linked to negative externalities (as environmental quality degradation costs, resource depletion costs) can be integrated to the waste management of companies. Only limited information is available on how this works within local governments. There are only studies of the authors Qian, Burritt and Monroe (2008, 2011) from Australia.

The case studies of Qian, Burritt and Monroe (2011) were aimed at EMA practices and motivation to its application. By interviews, data collecting and sorting and analysis at 12 local Australian governments of different size, EMA information in waste management were recorded (Table 5).

There are two aspects in the studies of Qian, Burritt and Monroe (2011): level of EMA in local governments and motivation for use of EMA in waste management of the municipality. Particular EMA information, as stated in Table no 5, were completed by the number of municipalities that follow the given information. Conclusion of the study is, that most of the municipalities follow 30 - 60 % of the EMA information, mostly dates in total without deeper specification. Hidden and indirect costs are mostly ignored. One of the municipality applies 95 % of EMA information.

Although local governments cannot be fully aware of the EMA concept, the same information are collected and communicated as in business.

One of the outcomes of the study is the growing concern in EMA information in waste management. If the information will serve as a useful tool that will help local governments to reach efficient outcomes, they will be use widely.

CONCLUSION

Many municipalities solve the problem of growing costs for waste treatment by growing fees for residents. The questions of waste management should be solved as a complex of activities with the aim of waste reduction, reuse and recycling. Waste can be considered as a source in economically sustainable environment, and in such system where it is able to provide information for decision making support.

Environmental management accounting presents such approach that combines data from financial and management accounting and data about material and energy flows in order to use material and energy efficiently, to ease the impacts on the environment, to reduce risks, to lower environmental costs and to improve net income of the company. Environmental management accounting means a certain form of external report, and experts of the environmental departments suggest to apply EMA or ecological footprint as a useful tool in local agenda.

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