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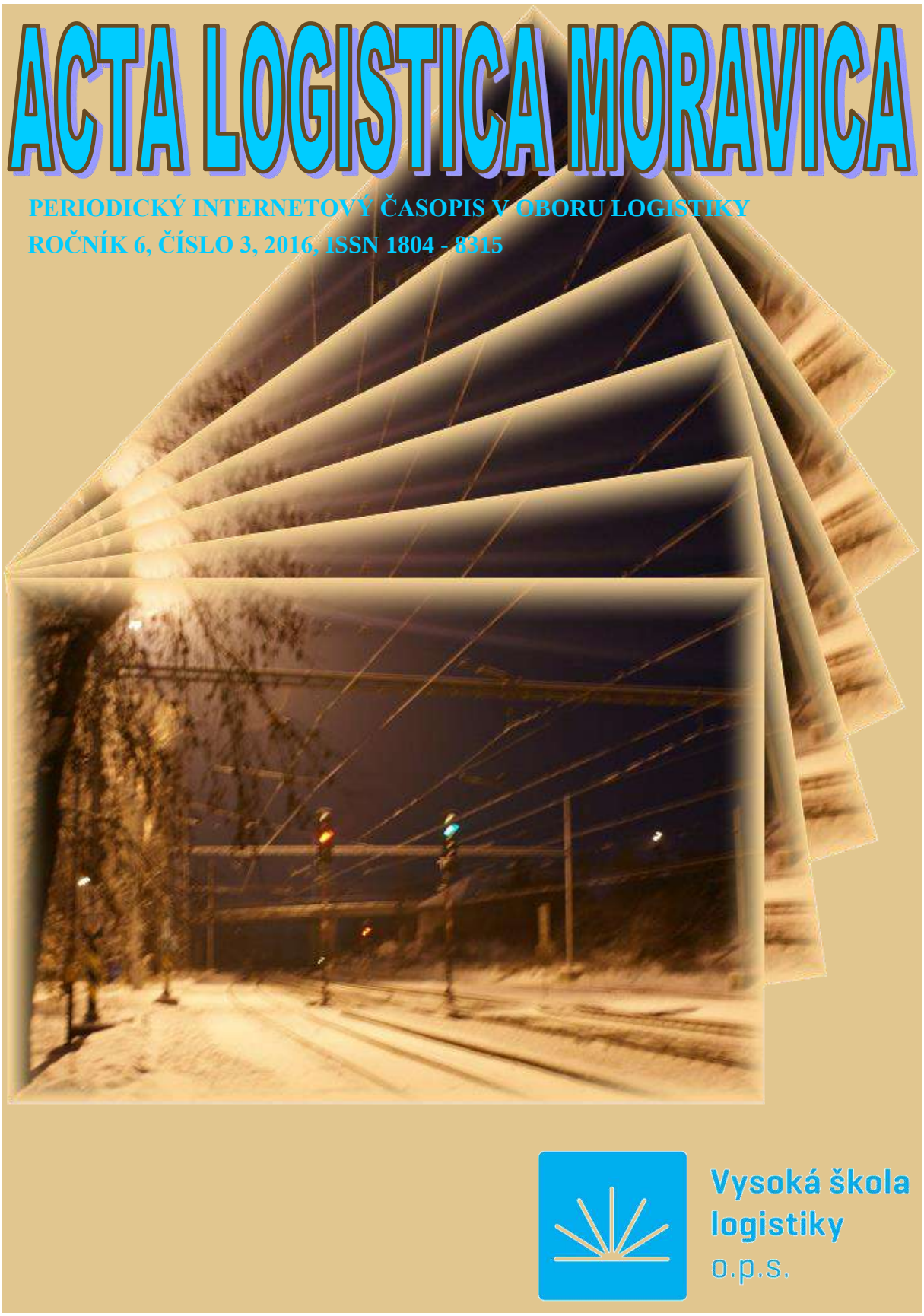

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17. INTERNATIONAL SCIENTIFIC CONFERENCE LOGI 2016

VŠLG Přerov

OCTOBER 12th - 13th 2016

Motto:

Logistics -the strategic factor of competitiveness

The 17th International Conference LOGI continues in the tradition established by Jan Perner Transport Faculty of University Pardubice. Recently, Jan Perner Transport Faculty continues in this tradition by cooperation with the Institute of Technology and Economics in České Budějovice and the College of Logistics in Přerov.

This year the International Conference LOGI will welcome Czech and foreign experts in logistics at the College of Logistics in Přerov. The Conference LOGI will be held on 12th – 13th of October 2016 at the premises of the Hotel FIT in Přerov. There will be discussions at the conference about the issues of new trends and expectations in logistics, the logistics activities, including logistics services.

The conference is thematically focused on the following issues:

- ***New trends and expectations in logistics.***
- ***Logistic activities and services.***
- ***Progressive technologies used in logistic processes.***

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CONTENT PROCEEDINGS

The 21st Century Industrial Logistic & Cyberspace

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Abstract: The political and economic landscape of world's largest economies has changed in recent years. Similar to NAFTA and Asian markets, accession of new member states to European Union (EU) presents a new challenge to guarantee sustainable and successful economic developments of all regions in EU. The fast exchange and delivery of natural and technological resources all across Europe, requires well planned and coordinated Intelligent Transport, Warehousing, Logistics and Information Communications Infrastructures in conjunctions with the Smart Web Logistics. The paper discusses issues related to new developments and research challenges the areas of Smart Transport Systems and Web Logistics technologies, while promoting research in Smart Logistics and Smart Transport Systems.

Keywords: Team Europe, Globalization, Transport, Future Logistics, Warehouse and Web Logistics.

1. Introduction

The economic and political landscape of Europe have changed significantly in past 20 years, which lays foundation for very dynamic growth in Business and Logistics. The enlargement of the European Community [1] created a new Team Europe [2] illustrated in Figure 1. The Team Europe is a large network of professionals specialising in current European affairs.

Figure 1: Team Europe.

The logistic industry is going through a time of rapid and unprecedented transformation. The

future of logistics is paved with innovation and technology. It was not long ago that ideas like 3D printing, the Internet of Things (IoT), drone delivery, and augmented reality were things of science fiction. Today, the industry is cautiously adopting these technologies to provide faster, cheaper, more reliable and sustainable delivery [3]. To make sure that Czech national economy continues to grow successfully, it makes no sense to have brilliant marketing programs to sell world-class products if the products aren't available:

a) at the right time

b) at the right place, and

c) in the right form and condition that consumers want them.

Poor customer service adds up to lost revenue and profit opportunities. Logistics can be simple understood as a set of activities that focus on getting the right amount of the right products to the right place at the right time at the lowest possible cost. While the Logistic Management include following activities:

- Organizing the Cost Effective Flow and storage of materials, in-process inventory, finished goods and related information;
- From Point of Origin to Point of Consumption;
- To satisfy Customer Requirements.

Figure 2: Marketing, logistics and supply chain management.

The Supply Chain management illustrated in Figure 2, is the integration and organization of information and logistics activities across firms in a supply chain for the purpose of creating and

delivering goods and services that provide value to consumers. Five stream of literature relate to logistics provider models [3, 4, 5] strategic decision making in organizations, industrial buying behaviour, transportation purchasing, supplier selection, and logistics relationships. Strategic alliances allow companies to reduce conflict, reciprocate regarding mutual goal-related matters, increase efficiency and stability, and establish market place legitimacy [6]. Logistics managers consider perceived performance, perceived capability, and responsiveness as important factors in selecting logistic providers [7].

2. The 21st Century Logisitcs

Evidence shows that the Business Logistics contributes to reduction of company's costs, while improving the customer service quality, as well as, increasing the synchronization of activities throughout the supply chain [8, 9]. In order to deliver expected results, offering both consulting and hands-on management support is most practical.

Figure 3: Future Logistics [Google pictures].

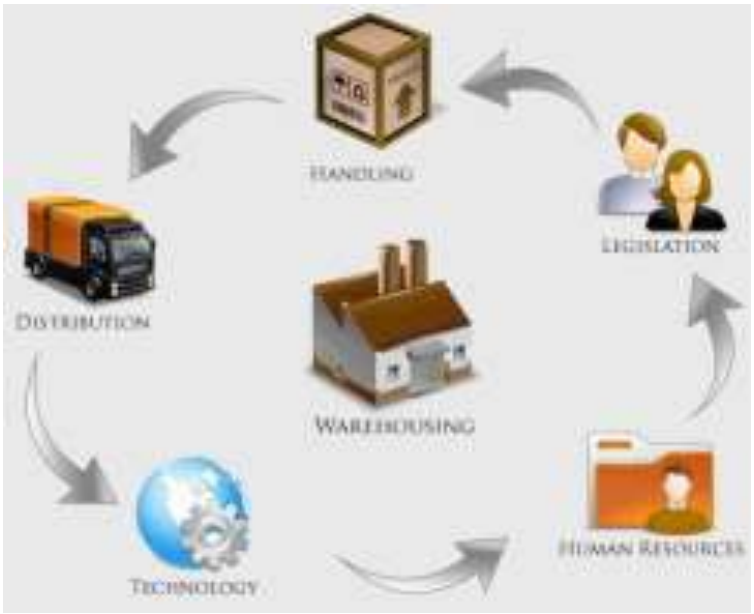

Figure 4: Warehousing and Web Logistics technologies [Google images].

Figure 3, illustrate the Future Logistics bringing together the real-time virtualisation, logistics connectivity and intelligence. Figure 4, illustrate the Logistics chain components connected directly to Web via Internet. The system brings together Human Resources, Legislations, Goods Handling and Distribution, with Technology. The activities related to warehousing, show the technology sector is directly connected to distribution and human resources, which via legislation(s) provides services to handling.

Exclusive auditing and cost benchmarking tools can identify opportunities to generate savings in your transportation, warehousing, and private truck fleet operations [10]. Business Logistics delivers a wide range of logistics solutions for its clients, including:

- Traffic and transportation management services;
- Inbound shipment management services;
- Freight cost reduction and containment programs;
- Freight bill auditing, payment, and information services;
- Geographic facility location studies;
- Logistics profit center development;
- Service quality improvement programs

Figure 5, illustrates the the logistics systems in automotive industry utilizing supplier network to facilitate auto manufacturing, marketing and selling to customers.

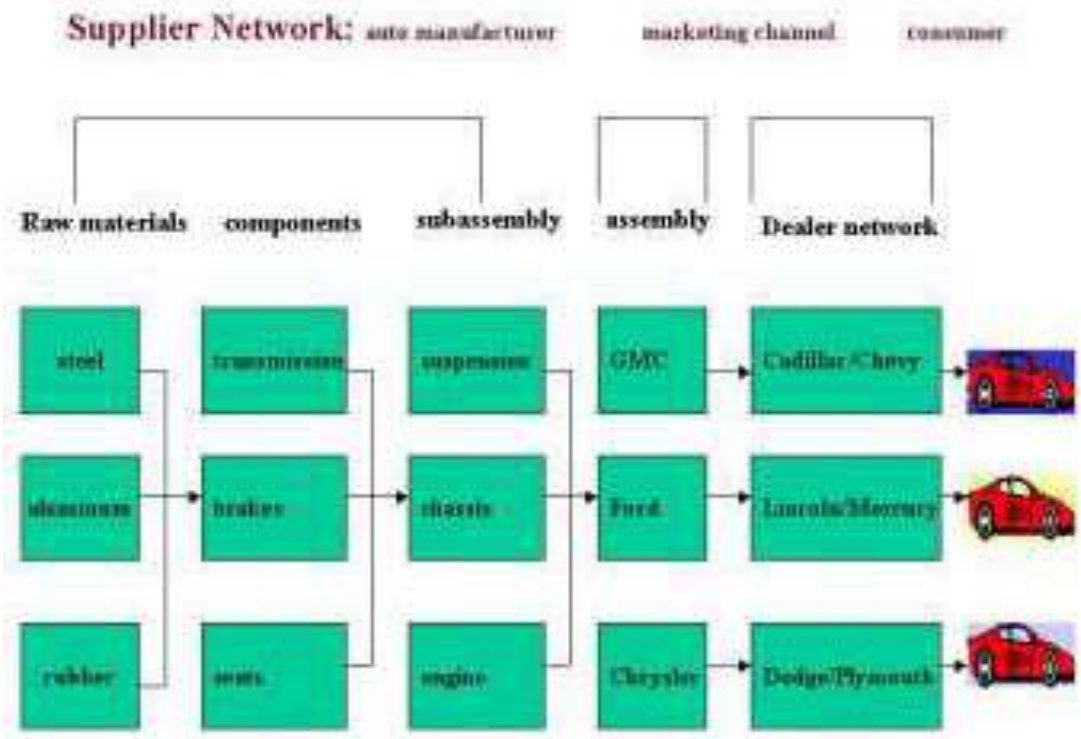

Figure 5: Automotive Supply Chain [11].

3. Case Study: Total Logistic Control

Total Logistic Control (TLC) delivers a strategic competitive advantage for customers by providing full service integrated logistic solutions. TLC will generate a superior return on investment by offering opportunities and rewards for its people [16, 17, 18]. TLC provides end-to-end supply chain solutions. TLC's capabilities range from transporting a single load and warehousing a few pallets to managing the entire transportation function or operating a dedicated manufacturing facility. TLC can engineer, implement, manage entire supply chain and encompasses all the key supply chain disciplines, including:

- Plan; Source; Make; Hold; Move

○ The TCL is sophisticated solution and in addition to above features the TLC system further facilitates:

- Logistic Management Services

○ Through a careful analysis of business requirements, cost drivers, service differentiators, facility infrastructure, and systems capabilities, TLC can custom design, implement, and manage a supply chain solution tailored to your specific needs. Warehousing. TLC offers short-term public warehousing, long term dedicated warehousing, and subcontracted warehousing services. The strategic network of dry and temperature controlled facilities support the diverse warehousing needs from pallet in/pallet out storage to quick-turn, SKU intensive picking, cross docking, consolidation, and fulfillment.

- Transportation Management

○ TLC can transport a single load, perform pool distribution, provide over-the-road contractual services, deliver direct to retail stores, operate dedicated fleets, as well as manage the entire transportation function. The TLC operates commercial multi-temperature truck fleet, while contracting with carrier partners to meet the needs of our clients.

- Procurement

○ The supply chain services include extensive procurement capabilities. Working with many of the nation's food and consumer goods manufacturers, TLC can source, negotiate, (re)order, and manage raw material and vendor inventory across large and complex product lines, for improved order fulfillment and lower inventory costs.

- Contract Manufacturing/ Packaging:

○ TLC contract manufacturing and packaging services offer flexible, cost-effective outsourcing solutions. TLC's management has worked closely with many top international companies in the design, construction, and operation of production facilities throughout the world.

- Logistics Engineering:

○ Uniquely qualified to provide Logistics Engineering, TLC offers the expertise of a top-flight engineering team whose operational experience crosses all supply chain disciplines. The company skills and investment in advanced optimization and modeling technology are enhanced by valuable experience in very complex, far reaching supply chains [12, 13, 14].

The practice show evidence that current logistics systems are fully computerised and utilise sophisticated software across large distributed Telecommunications and Data network infrastructures. For the purpose of technical clarity following section in italic print was adopted from Application Technique Nouvelle in France [15, 16, 17, 18].

4. Conclusion

The logistic systems for the 21st century entered a new era of innovation and technological advancements. European and world's business are becoming more and more computerised having a global vision for the future. The field of modern Logistics utilizes the results in the field Informatics, Engineering, Mathematics, and Business. Global Internet and Telecommunications infrastructures are essential platform for national and global logistics providing high quality services to anyone, at any-time, any-where at minimum cost. The

emergence of advanced data and telecommunications technologies combined with convergence of industry standards, as well as the convergence of yield and equipment productivity management prepare a platform for future developments and research in the field of logistics. The paper discusses the challenges facing the European integration in light of applied logistics. The author concludes the paper discussing the concept of Logistics Control as the essential platform for current logistics solutions.

Acknowledgments

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Supporting the Connection the Logistics Centres to Rail Network

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Abstract: The paper describes the issue of supporting the connection of logistics centres to rail transport. The issue of developing a new logistic parks and logistics centres is very current in Central Europe. The transitive economics like Slovak Republic and Czech Republic are very open to the development of logistic technologies as well as to build new logistic chains. The problem is the decreasing share of modal split for rail transportation what does not meet with the transport policy of EU. This could be further increased by constructing private siding in logistics areas. There is need to analyse current status of the public logistic parks and logistics centres development on defined area. The key issue is how to connect these centres to the rail network, to analyse the legislation and others obstacles for their connection to the rail network. The proposal could also be an answer for how to increase the level of support of rail transport usage in logistic chains.

Keywords: Logistics park, public logistics centre, railway network, the legislation, logistic chain.

1. Introduction

The paper describes the issue of supporting the connection of the logistics centres to rail infrastructure. This issue is very current nowadays, because rail transport is becoming important and more efficient, both in terms of the large amount of goods transported by railway transport, as well as the positive impact on the environment. This growth could be increased by the construction of railway sidings directly to logistic areas or parks.

2. Current status of logistics centres in Slovakia and in Czechia

There is an increasing number of logistics centres in the central Europe, specifically in Slovak Republic and in Czech Republic. Most of them are connected to the road network only. Thereby it is completely ignored multimodality specific connection to the railway network. In other European countries rail transport starts having a dominant position, due to its advantage of transport capacity and environmental friendliness. Therefore, there is necessary to deal with the problem of how to connect these centres to the rail network by the private railway siding. [1,4]

2.1. Public logistics centres

The current state of logistic centres development in Slovakia and the Czech Republic can be characterized in particular by not having the unified approach at the state level that promotes the creation of logistics centres with public access so that they support economic and regional economic growth, national economy and effective modal split [6].

Key characteristics of a public logistics centre:

- group of companies, which are involved in the transportation of goods, logistics service providers and companies associating with the production and logistics,
- access to two modes of transport at least, particularly for road and rail transport (intermodal transport terminal),
- the owner or operator of a local logistics centre initiates cooperative activities to achieve synergies in logistics centres under its control [1].

The most important trend towards intermodality of public logistics centres (as interface between different transport modes) is to provide optimal conditions for the creation the intermodal transport chains. The possibility to use an alternative transport mode does improve business flexibility and guarantees the quality of logistics services. Railways and inland waterways benefits from the growth of the freight transport market, because logistics service providers are closely connected to intermodal transport terminals. The high dependence of logistics on road transport is effectively combined with the benefits of other transport modes. [3]

Various strategic documents with differently formulated objectives in the field of transport respond to the current state of intermodal transport infrastructure:

- In the field of intermodal transport terminals the developed infrastructure is essential to ensure transferring goods from one transport mode to another easily, reliably and cost-effective.
- Improving the accessibility of European transport network from all regions of Slovakia, increasing the availability, capacity and speed of communications systems in the regions.
- Ensuring the high-quality accessibility of residential areas and basic transport service, reduction of accident rate, time losses and transport risks [3].

A common feature of these objectives is that they are orientated to the field of intermodal transport, specifically to construction of terminals as a transfer point for goods. In a broader context, it is about building logistics centres with comprehensive logistics services, which increase competitiveness of regions as well.

2.2. Rail freight corridors

There are nine rail freight corridors (RFC) running through the whole Europe, three of them (RFC 5, RFC 7 and RFC9) run through the territory of the Slovakia and four of them (RFC 5, RFC9 7, RFC 8 and RFC 9) run through the territory of the Czech Republic.

- RFC 5: Corridor Baltic – Adriatic:
  - Gdynia - Katowice - Ostrava / Žilina - Wien - Klagenfurt - Udine - Venice / Terst / Bologna / Ravenna, or Graz - Maribor – Ljubljana - Koper / Terst,
- RFC 7: Corridor Orient/East-Med:
  - Prague – Vienna/Bratislava – Budapest – Bucharest – Constanta and Vidin – Sofia – Thessaloniki – Athens axis,
- RFC 9: Czech-Slovak Corridor:
  - Praha – Horní Lideč / Ostrava – Bohumín/Havířov – Žilina – Košice – Čierna nad Tisou / Maťovce,
- RFC 8: North Sea – Baltic:
  - North Sea ports of Wilhelmshaven, Bremerhaven, Hamburg and Amsterdam, Rotterdam, Antwerpe – Aachen – Hannover/Berlin – Warsaw – Terespol (Poland-Belarus border) / Kaunas / Falkenberg – Prague / Wroclaw – Katowice [5].

Logistics centres have been examined not only in terms of connection to the rail network, but

also according to EC Regulation 913/2010 in terms of connection to the rail freight corridor (RFC), if it runs in the vicinity of selected logistics centres. [3]

2.3. Logistics centres in Slovakia

Most of the existing logistic centres in Slovakia have no connection to the railway network, because there haven't planed and built the private railway sidings, which would provide it. For this reason the logistics centres use only road transport (monomodality), except logistics centres Point park Bratislava, Beta – car Pezinok, logistics parks in Devínska Nová Ves and Maťovce, which are connected to the rail network. Table 1 gives an overview of the public logistics centres in Slovakia in terms of their connection to the railway network, it means if they have a private siding or if there is the possibility of building siding and also the connection to the freight corridor (if RFC distance is not more than 50 km). [8]

Table 1: Public logistics centres in Slovakia and their connection to the rail network

Logistic centre	Siding	Possibility of connection to the rail network	Nearby RFC Corridor
Logistics centre Nové Mesto nad Váhom	–	✓	✓ RFC 9
Logistics park Nové Mesto nad Váhom	–	✓	✓ RFC 9
Logistics centre Point park Bratislava	✓	–	✓ RFC 5,7
Logistics centre Svätý Jur	–	✓	✓ RFC 5,7
Logistics centre Trnava – Zavar	–	✓	✓ RFC 5,7
Logistics centre Eurovalley	–	✓	✓ RFC 5,7
Logistics centre Devínska Nová Ves	✓	–	✓ RFC 5,7
Logistics centre Maťovce	✓	–	✓ RFC 9
Logistics centre Beta – car Pezinok	✓	–	✓ RFC 5,7
Logistics park WESTPOINT near Lozorno	–	✓	✓ RFC 5,7

2.4. Logistics centres in Czech Republic

Table 2 gives an overview of logistics centres (parks) in the Czech Republic that are or may be connected to the railway network by the railway siding. All logistics centres (36 centres) have been analysed and only 2 of them have a connection to the railway network and they can be said to be multimodal. The remaining 21 logistics centres are not connected to the railway network, but based on the analysis the conditions for their connection to the railway network through a railway siding are created. The table also shows the possibility of logistic centres connection to the international freight corridors RFC, if RFC distance is not more than 50 km. [7]

The map of the Czech Republic (Fig. 1) shows public logistic centres that should be connected to the rail network due to their location. Furthermore, we can see on the map if the centres are located close to the corridors, which could be their competitive advantage in case they already have or if they possibly could construct the siding. [7]

Table 2: Public logistics centres in Czech Republic and their connection to the rail network

Logistic centre	Siding	Possibility of connection to the rail network	Nearby RFC Corridor
HÖDLMAYR LOGISTICS	✓	–	✓ RFC 7,8
PANATTONI PARK	–	✓	✓ RFC 7,8
P3 PRAGUE BLUE PARK	–	✓	✓ RFC 7,8
P3 PRAGUE GREEN PARK	–	✓	✓ RFC 7,8
P3 PRAGUE D11	–	✓	✓ RFC 7,8
P3 PRAGUE HORNÍ POČER.	✓	–	✓ RFC 7,8
P3 PRAGUE D1	–	✓	✓ RFC 7,8
P3 PŘEDLICE	–	✓	✓ RFC 7,8
P3 MLADÁ BOLESLAV	–	✓	–
P3 PŘÍŠOVICE	–	✓	–
P3 TURNOV	–	✓	–
P3 LIBEREC	–	✓	–
P3 HRADECE KRÁLOVÉ	–	✓	–
P3 OLOMOUC	–	✓	✓ RFC 5,9
PROLOGIS: PRAHA AIRPORT	–	✓	✓ RFC 7,8
PROLOGIS: PRAHA JIŘINY	–	✓	✓ RFC 7,8
PROLOGIS: ÚŽICE	–	✓	✓ RFC 7,8
CTPARK PRAGUE NORTH	–	✓	✓ RFC 7,8
CTPARK JIHLAVA	–	✓	–
CTPARK POHOŘELICE	–	✓	–
CTPARK MODŘICE	–	✓	✓ RFC 5,7
CTPARK BRNO	–	✓	✓ RFC 5,7
CTPARK HRANICE	–	✓	✓ RFC 5,9

Figure 1: Public logistics centres in Czech Republic and their connection to the rail network.

3. Comparing of logistics centres

When analysing individual logistic centres in Slovakia and Czech Republic serious deficiencies in succeeding in the logistics market are evident. Logistics centres in Slovakia with a few exceptions (Logistics centre Bratislava-Rača) show a lot of deficiencies in comparison with the logistics centres in the Czech Republic in all analysed areas. [4]

Great deficiency in existing logistics centres in the Slovak Republic is their monomodality, because most of them are connected only to the road network. Due to this connection they are losing interest of potential customers, which prefer another mode of transport, e.g. rail transport. The most of logistics centres in the Czech Republic are bimodal centres with connection to the road and rail network as well. Some logistics centres are even trimodal with connection to river transport (river Elbe), eventually they have good access to international airports and can also use air transport.

Another deficiency in the Slovak Republic is the interconnection of logistics centres with intermodal transport terminals. If the logistics centres had been connected to intermodal transport terminals, they would been more attractive for their potential customers. Services provided by logistics centre and by intermodal transport terminal would have been provided at one place and thereby additional costs would have been saved. In the Czech Republic the most used and most efficient are just the logistics centres that are connected to the intermodal transport terminals.

Another issue is the location of individual logistics centres in the country. The existing ones but also those planned logistics centres are located only in certain industrially advanced regions – in capital city Bratislava and its surrounding, near KIA Motors in Žilina and in the two large cities in Eastern Slovakia, Košice and Prešov.

In the Czech Republic Hub n Spoke system it is successfully used, which centralises most of the traffic flows in the centre of the country, specific Logistics centre in Prague, which is operated by Metrans. It offers one of the ways to increase the efficiency of small logistics centres in less industrially advanced regions of the country.

The main deficiency of logistic centres in Slovakia based on previous analyse, is the lack of storage capacity and insufficient connection to the various transport modes. These deficiencies relate and directly lead to significantly less number of logistics centres compared to Czech Republic. [8]

4. The proposal of connection the logistics centres to rail network

The proposals that directly support the principles of design, construction and operation of public logistics centres and their connection to the railway network, should be adjusted to existing laws and regulations into one law, both in Slovakia and in the Czech Republic. Specifically, it is necessary to incorporate following provisions into the new law: [2]

- newly built public logistics centres will be required to be connected to the railway network (building a railway siding if its length to the nearest connecting station does not exceed 4 km, or to build a railway siding regardless of its distance to the nearest station, if the logistics centre is located within 50 kilometres of RFC),
- public logistics centres have the status of public interest,
- after meeting the requirements , the financial support for the construction of public logistics centre or intermodal transport terminal will be used (in particular the construction of the park or siding and the purchase of technical equipment),
- existing and new industrial zone will be required to build a railway siding (due to high

concentrations of undertakings), and only if there are difficult natural obstacles (rocks, hills, rivers, etc.) there will be an exemption for specific company for not building it.

This will lead to additional incentives for the creation of multimodal public logistics centre, particularly in the area funding through EU structural funds.

5. Conclusion

The basic characteristic of the most existing logistic centres in Slovakia and the Czech Republic is theirs monomodality. In comparison to other European logistics centres almost all of them are connected to road transport only. Rail sidings are missing in majority of existing logistics centres in Slovakia and rail connection to the state country network is not ensured. Nowadays some logistic centres in Slovakia are located near railway lines or international airports, but they have no direct connection to them.

As emerged from the analysis of public logistics centres in Slovakia and Czech Republic only a small number of public logistics centres are connected to the railway infrastructure through railway siding, in particular it is 7.9% in Slovakia and 5.5% in the Czech Republic.

In the legislative area it is necessary to define the public logistics centres and their connection to the rail network as the public interest and incorporate these definitions to the new law following the EU transport policy.

Acknowledgments

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The Selection of Logistics Services Providers Using Mathematical MCDM Model

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Abstract: Currently, we may notice the growing trend in the world, where companies are allocating services that are not part of the core business. Distribution logistics seems like the ideal part of the logistics chain suitable for outsourcing, as companies can use the know-how and equipment of logistics providers to reduce their distribution costs and maintain or increase the level of customer service. The main content of the paper is to design and create the model for the selection of the logistics service providers, verification of the model and the following application of that model in the company operating in the Czech Republic.

Keywords: Distribution logistics, outsourcing, model, logistics service provider, ANP.

1. Introduction

When looking at the actual problem of the choice of criteria for the selection of suitable logistics service providers (not only) at 3 PL level, the situation is not uniform. It could be noted that with each author comes a new set of selection and evaluation criteria. Selecting individual criteria obviously has to adapt to the selected research targets or to the requirements of the company, but some unification of the procedures for selection of the criteria would certainly be of use. This problem can also be seen in the choice of methods and approaches for the actual selection of logistics service providers. The scientific publications offer various approaches appropriate for this selection, whereby the composition of the chosen methods depends on the preferences of the researcher of the study. From the perspective of Multiple Criteria Decision-Analysis (MCDM) there is a wide range of methods used for dealing with services logistics provider selection.

Table 1: Review of MCDM techniques in the scientific literature.

	Technique	*Authors*
Individual Approach	Data Envelopment Analysis (DEA)	Liu et al. (2000); Narasimhan et al. (2001); Talluri and Sarkis (2002); Sedel (2006); Saen (2007)
	Mathematical Programming	Wadhwan and Ravindran (2007); Narasimhan et al. (2006); Hong et al. (2005)
	Analytic Hierarchy Process (AHP)	Chan (2003); Liu and Hai (2005); Hou and Su (2007)
	Analytic Network Process (ANP)	Sarkis and Talluri (2002); Bayzit (2006); Gencer and Mohapatra (2006)
	Case-based reasoning (CBR)	Choy and Lee (2002); Choy et al. (2005)
	Fuzzy Methods (FST)	Sarkis and Mohapatra (2006); Florez Lopez (2007)

Combined Approach	AHP - DEA	Ramanathan (2007); Saen (2007); Sevkil et al. (2007)
	AHP - DEA - ANN (Neuronové sítě)	Ha and Krishman (2008)
	AHP - MODM	Xia and Wu (2007)
	ANN - CBR	Choy et al. (2003; 2004)
	ANN - MODM	Demirtas and USTUn (2008)
	DEA - MODM	Weber et al. (2000); Talluri et al. (2008)

An analysis of the current state of problems in both the Czech Republic and abroad did not result in any unified model applicable the selection of the various logistics service providers. For individual companies, it is very difficult to choose a reliable provider of logistics services according to their own criteria [2], [3].

These companies then restrict their selection on several important criteria, such as price, according to which the logistics service provider is chosen [4]. This approach, however, is wrong from the point of view where price is not the single most important criterion when choosing a logistics provider [5]. With a more complex selection model, which involves more criteria, the company can get completely different results for selection, where despite the higher price they will get better service within their distribution logistics [6].

Based on the above analysis of the current situation there is a dire need for a unified model, focusing on the choice of logistics service providers, with the possibility of adapting to the needs of various companies. In particularly, the option of adding or removing selection criteria is useful for a company.

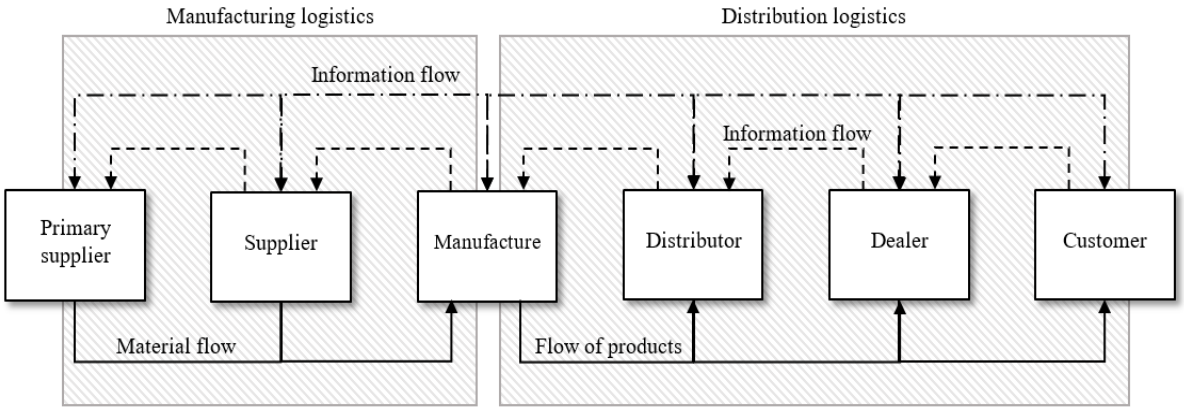

Figure 1: Supply chain divided into two section with an internal distribution part

2. Methods

The aim of this chapter is design, functional verification and subsequent application (validation) of models for the selection of logistics service providers for the distribution part of the logistics chain. To meet this goal, there were used methods and approaches from the previous chapter and the knowledge derived from the processing of the analysis of the current state of distribution logistics and distribution logistics outsourcing in the Czech Republic and abroad.

2.1 The design of a model for the selection of logistics service providers

Selecting logistics provider is an important decision before the conclusion of a service contract within the distribution logistics for the company.

Logistics services providers selection on the based on all of the relevant selection criteria may reduce risk of failure and leads to mutual and beneficial cooperation [7]. A model was designed, which contains eight stages, from defining the objectives of the model to the determination of the outcome of the model.

Within the model, the author suggested three ways of identifying criteria - the company does not know the relevant selection criteria for logistics services providers selection using Delphi method [8]; the company knows these criteria using Saaty's matrix [8], but not the weight (importance) of these criteria for the resulting model; or knows both the criteria and importance and it is possible to proceed directly to the creation of the model.

The following step is conduct consistency analysis for all pairwise comparison in the model [9, 10]. An important factor, which is necessary to pay attention to when using the paired comparison, is the consistency test [9]. In the case when there is no conversion to elementary scale and judgment is used, there almost always emerges an inconsistency (provided that a is 3 times better than b, but only 0.2 times as good as c, to avoid inconsistencies c would have to be 15 times better than b). Given the characteristics of reciprocal matrices and eigenvalues, a minor inconsistency plays no role in determining the vector priorities [14]. The degree of consistency to 0.10 (10 %) is considered acceptable [15]. For higher values the matrix of paired comparisons should be adjusted, otherwise the results of the entire model quickly lose its informative value. These are processed with ANP schematically shown in Figure 2.

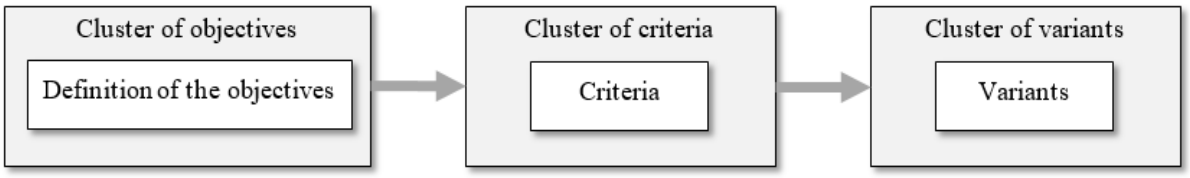

Figure 2: Schematic representation of the AHP method

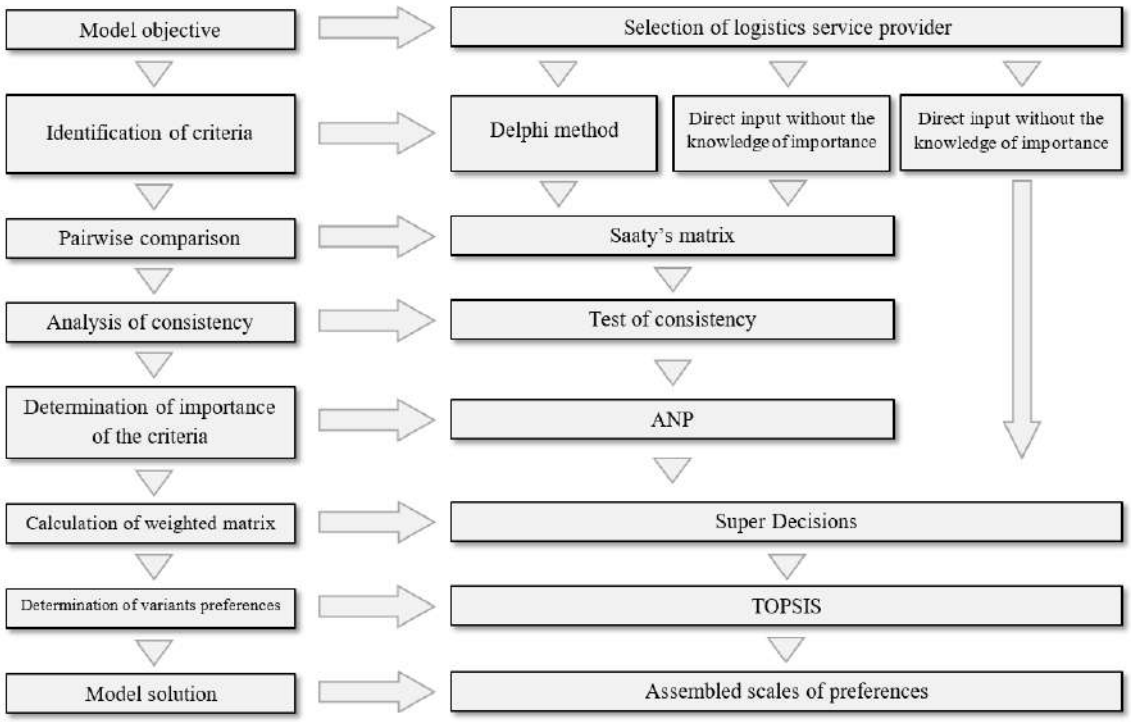

Figure 3: Design of the model for the selection of external service provider

For this step has been used a special decision making software Super Decision. The final matrix obtained from the Super Decision is processed with TOPSIS and the final results are obtained [13].

3. Results

To protect the internal data of the company, its name, for which the model was applied and tested, is in this part of the paper replaced with a general term "Company". Likewise, the names of individual logistics service providers were anonymized, in order to avoid data misusage by the competitors. The names of these companies have been replaced by the general term "Provider". But it is possible to specify general information about the company.

We are talking about an engineering company, operating in the Czech Republic with four branches in Prague, Pardubice, Brno and Ostrava, with one factory. For the distribution of products (spare parts, components, individual machines and complete machine plants) used in the past by a combination of mail order companies, private carriers and own vehicles. Due to the company's growth status this was unsustainable and the company decided to leave the distribution to an external logistics service providers. The proposed model was compiled on the basis of cooperation with nine members of management of the company. 24 selection criteria were identified, which were subsequently incorporated into the model for the selection of logistics service providers.

The aim of this decision was to streamline the delivery of products to end customers, reduce waiting times for delivery, focus on actual production and sales activities and increase the customer service. The calculation itself is multi-steps according to the diagram shown in figure 1 which has been develop for this purpose by the authors. After preparing and calculating the model for PLS selection, Provider 2 was selected as the best choice. Detailed calculation is not a part of this paper according to the length.

Table 2: Design of the model for the selection of external service provider.

	Distance vector from ideal variant	**Distance vector from basal variant**	**Relative indicators**	**Percentage indicator**
Provider 1	0,1472	0,0614	0,2945	**0,2231**
Provider 2	0,0530	0,1697	0,7619	**0,5772**
Provider 3	0,1549	0,0554	0,2636	**0,1997**
Sum			1,3199	**1,0000**

4. Discussion

In the event that the company decide to use the services of an external provider, it is important to carefully select a partner. A wrong choice can bring problems for the company and subsequently lead to the collapse of cooperation with the PLS.

One of the most important parts of the model is an initial identification of relevant selection of criteria and then determination of their magnitude (importance) for the final model. Close attention needs to be paid to the identification of individual criteria, because mistakenly selected individual criteria may make it difficult to calculate the entire model, or skew the whole results.

For this reason, the model includes three methods of identification of the criteria and calculates their importance.

A very important part of the proposed model is the inclusion of the consistency test for each pairwise comparison. Thanks to this test, consistency and relevance of the whole model is guaranteed. When creating a paired comparison, there is always a certain inconsistency of paired comparisons, while the goal is not to exceed the reported degree of consistency. Otherwise the model would lose evidential value and its results would not be possible to use or they would be distorted. To calculate not only the magnitude of the criteria, but also the interdependencies, it is proposed to use the ANP method. This method is useful primarily because of the possibility of creation criteria with the same focus and their subsequent comparison, both with regard to the criteria contained in the group and individual groups themselves. The output of the ANP method is called a scaled super-matrix. It is used as input for the TOPSIS method, with which is the final result calculated on the basis of minimizing the distance from the ideal variants and maximizing distance from the basal variants.

5. Conclusion

Access to the selection of external logistics providers strongly influences the efficiency of distribution networks. Identification of suitable logistics service providers in the distribution chains becomes a key strategic issue. Such decisions are usually complex and incoherent. The problem of choosing a provider of logistics services is a multi-criteria problem of group decision making. When selecting suitable providers, one must take into account a number of criteria, which often differ from company to company and can be both quantitative and qualitative.

The choice of external logistics service providers is still not sufficiently explored in the Czech Republic and a suitable model for the selection and evaluation of logistics service providers does not exist. Looking ahead, it is further assumed that the importance of the distribution of logistics chains will increase. With the expansion not only of the growing sales via e-commerce, but also of the ever increasing demands of end consumers, will the quality requirements for the distribution of individual companies continue to increase. The objective will be to set the most efficient logistics and distribution to meet the demanding requirements of individual customers and to have acceptable costs for individual companies.

Acknowledgments

The authors would like to thank everyone who participated in this research for their valuable suggestions, comments and ratings. Big thanks also goes to all employees of the discussed company for their patience and willingness during the input evaluation processing for the model creation. The work was created in connection with the scientific research project of the University of Pardubice no. SGS_2016_008.

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Modelling Framework and Assistive Device for Peripheral Intravenous

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Abstract:

This article sets out to characterize a logistics centre as an integrated system composed of individual subsystems, elements and specific relations between them. The logistics centre system is not only described here, but is also expressed mathematically. All of the identified subsystems and elements of the logistics centre system can subsequently be analysed in real terms by accountable members of staff in order to implement improvements in its planning and management.

The author goes on to focus on the actual design of logistics centres and identifies the main factors that must be taken into account during the designing process. A general algorithm is subsequently put forward to be used within the context of planning logistics centres.

In conclusion, compliance with the main design factors for logistics centres under real conditions, based on the author´s self-selected sample of representative European logistics centres, is verified.

Keywords: System, subsystem, logistics centre, planning, design, algorithm.

1. Introduction

A logistics centre is characterized by the cooperation of business entities from different fields who jointly use its central building and service facilities. This cooperation brings about synergetic effects to all the partners located in the same logistics centre [1].

A logistics centre represents a crucial link in the logistics chain. It is a designated place where a concentration of a broad spectrum of logistics services is provided, including combined transport, and which provides transport services by at least two modes of transport in the particular area. These centres are ideally established in areas with adequate material flows and with the possibility to directly connect to transport infrastructures, which at the same time should have sufficient capacity. To be more specific, large agglomeration economies, important intersections, etc. are the main areas for establishing these logistics centres [9].

2. Methods

This study is conducted on the grounds of an analysis and a follow-up synthesis of the issue and also on a systemic view of a logistics centre as a management object. In-depth secondary research represents a valuable information source for the clear definition and systemic determination of a logistics centre. The compliance with the main design factors is verified, using a selected sample of representative European logistics centres and on the basis of the statistical method of a multi-criterial assessment of the variants with respect to the arithmetic mean, as follows [2]:

$$\bar{x} = \frac{\sum_{i=1}^{n} x_i p_i}{\sum_{i=1}^{n} p_i} = \frac{x_1 p_1 + x_2 p_2 + \ldots + x_n p_n}{p_1 + p_2 + \ldots + p_n} \quad (1)$$

where:

x…value;

p…weight.

Factual information on a logistics centres' individual representatives is taken from appropriate secondary sources (internal materials, websites and web maps). The results of this research are subsequently subjected to a comparative analysis at the end of the article.

3. A logistics centre as a functioning system

An integrated logistics centre is an object that simultaneously meets the following four major requirements:

1. Access to at least two modes of transport
2. Utilization of combined or intermodal transport technologies
3. Freight operations prevail over transhipment operations.
4. Operators performing freight-handling operations participate in integrated logistics chains.

A logistics centre can also be viewed as a management object, which can either be assessed on the basis of its individual processes or on the basis of its management functions, including planning, organizing, human resources and the centre's process controls. As is the case for any other system, such a centre is composed of elements and relations between them as well.

The logistics centre system may mathematically be expressed in the following set:

Slc = <Sw, Sc, Ri>, (2)

where:

Slc…logistics centre system;

Sw…work system;

Sc…control system;

Ri…relations.

According to Langemin and Riopel [3], a logistics centre´s main work system consists of a number of subsystems for:

- receipt of goods;
- freight transport;
- materials storage;
- assembly of handling units;
- issuance of goods;
- other(s);
- relations.

The main objectives of the aforementioned subsystems are outlined below.

The receipt of goods involves unloading, quality control, unpacking and repacking, labelling, storage preparation and documentation handling.

Freight transport encompasses elements of transport use and its operation – intermodal, multimodal, combined and in-house, as well as the selection of the means of transport.

Materials storage, or goods and warehousing, are subject to the correspondingly adopted technology and organization.

Assembly includes the handling of units, the loading thereof on outbound means of transport and the shipment of goods.

In addition to the basic components of a logistics centre´s work system, there is also an auxiliary work system (Sw), formed by subsystems for infrastructure (Si), exploitation (Se), customs (Sc), hotel-gastronomy (Shg), fuels (Sf), environmental protection (Se) and other subsystems (Sj) and relations (Ri).

All of these may be mathematically expressed in the following set:

Sw = <Si, Se, Sc, Shg, Sf, Se, Sj, Ri> (3)

The auxiliary system´s major task is to secure the correct functioning of the main work subsystem, as well as the logistics centre as a whole, with the particular subsystems´ main tasks arising from their titles (see above).

The last subsystem is a controlling subsystem (Sc), which is expressed as follows:

Sc = <Scu, Sm, Sek, Sij, Sinf, Ri> (4)

The controlling subsystem (Sc) consists of control units (Scu), represented by the managing director, deputy directors, supervisory board, etc., and further by subsystems for marketing (Sm), finance (Sek), IT (Sinf), relations (Ri) and other subsystems (Sj) related to administration, social management, etc.

5. Algorithm for designing logistics centre

The configuration of the algorithm for constructing a logistics centre was based on the following steps [4]:

1) Demand analysis – this involves determining both the present and future demands for logistics services; logistics market size; consumption levels; labour market and economic development.
2) Location analysis – this involves issues relating to the structure of industrial transport; availability of transport infrastructure; terrain investments; local government policy; assessment of potential conflicts and threats.
3) Feasibility analysis – this includes an economic and financial risk analysis; assessment of environmental threats; evaluation of social and economic effects.
4) Implementation analysis – this involves the selection and implementation of organizational and functional options; ownership and capital structures; development strategy.
5) Implementation plan – this involves a definition of the integrated logistics centre´s final size; implementation schedule; method of investment funding; forms of the use of investment.

6. Verification of compliance with the main design factors for a logistics centre

Table 1 provides an overview and evaluation of a selected sample of representative logistics

centres in the Visegrad group of countries according to various design factors. The evaluation is based on the subjective determination of the importance (weight) of these factors (criteria) as determined through the use of geographical maps, information on the economic situation in the given territory, where the centres are located and from available internal information on the individual logistics centres [5], [6], [7], [8].

Score 1 point is the worst, rating of 5 points best.

Table 1. Evaluation of selected representative logistics centres

Name of logistics centre, country	**Design criteria**	**Weight of criteria** (1 to 5)	**Evaluation of meeting the criteria** (1 to 5)
Amazon, Praha, CZ	Configuration of logistics network	**5**	**5**
	Localization	**4**	**5**
	Services	**4**	**4**
	Supply chain management	**5**	**5**
	Compliance with the conditions of governmental policy	**4**	**3**
Morzis, Bratislava, SK	Configuration of logistics network	**5**	**5**
	Localization	**4**	**5**
	Services	**4**	**4**
	Supply chain management	**5**	**5**
	Compliance with the conditions of governmental policy	**4**	**5**
Fresh Logistics, Gliwice, PL	Configuration of logistics network	**5**	**5**
	Localization	**4**	**4**
	Services	**4**	**3**
	Supply chain management	**5**	**5**
	Compliance with the conditions of governmental policy	**4**	**5**
Yusen, Budapest, H	Configuration of logistics network	**5**	**5**
	Localization	**4**	**5**
	Services	**4**	**4**
	Supply chain management	**5**	**5**
	Compliance with the conditions of governmental policy	**4**	**5**

Source: Author

Table 2 presents the overall evaluation of the representative logistics centres in terms of how compliant they are with the major design criteria according to a statistical calculation of the weighted arithmetic mean.

Table 2. Evaluation of logistics centres in terms of their compliance with the major design criteria

Name of logistics centre, country	Overall evaluation of achieving the major design factors	Percentage of achieving the major design factors
Amazon, Praha, CZ	**4.45**	4,45/5 = 0,89 → **89**
Morzis, Bratislava, SK	**4.82**	4,82/5 = 0,96 → **96**
Fresh Logistics, Gliwice, PL	**4.45**	4,45/5 = 0,89 → **89**
Huawei, Budapest, H	**4.82**	4,82/5 = 0,96 → **96**

Source: Author

7. Discussion and Conclusion

As is suggested above, a logistics centre can be viewed as a management object, which can either be assessed on the basis of its individual processes or on the basis of its management functions. From the systemic point of view, a logistics centre is composed of subsystems, elements and specific connections between them.

The logistics centre system may mathematically be expressed in the following set:

Slc = <Sw, Sc, Ri>,

where Slc represents the logistics centre system as a whole, which consists of three basic components, namely a work system (Sw), a control system (Sc) and relations (Ri).

The main factors influencing the design of any logistics centre includes the parameters for the logistics network configuration, location, services provided and their structure, tasks, as well as the significance and impact of logistics centres on supply chain management and respect for government policy.

The model through which it was verified that logistics centres meet the determined design criteria (on the basis of a random selection of representative logistics centres), indicates that the selected logistics centres accept the aforementioned factors to a large extent. On the basis of the analysis and a subjective assessment thereof, 89 to 96% of logistics centres meet the design criteria.

The recommended method for the configuration of the algorithm for designing a logistics centre, which is based on the experiences of multinational companies that construct logistics centres, includes five basic steps: demand analysis, location analysis, feasibility analysis, implementation analysis and an implementation plan.

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Possibility CAM Software Application for Increase Efficiency of Production Programming Component in the Digital Company

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Abstract: The article deals with possibility CAM software application for increase efficienty of production programming component in the digital factory. One oneself by over CAM software applications, who oneself nowadays to use in the various industrial sectors of and pro different shapes, measurements and surface finish part. For comparison options were they chosen software applications WorkNC G3 21.06 and Creo 2.0. Evaluation was her effectiveness and speed working with tools individual application used in the various industrial sectors.

Keywords: Digital company, CAM software, production programming component.

1. Introduction

We will deal with the company running the principles of Industry 4.0. Any industrial company revolves around its products. The basic imperatives of the market as price, speed of delivery, and, more recently, excellence, and product diversity. More and more talk about the personalization of the product that we are the manufacturer to produce peace. Quality has become commonplace today, tou can distinguish at least, a major factor in the success has also become a brand. What makes the world's largest recommended by experts addressed as the first phase of implementation of Industry 4.0 in the company's "operational effectiveness". Increasing productivity, reducing costs, shortening deadlines. Thus, primarily to respond to what the market requires. The Industry 4.0 is a carrier filling digitization. The digitization of the target thinks the two directions of communication. Vertical links all internal processes in the company. The second is the horizontal links all subjects included in the product life cycle, in the actual manufacturer, its suppliers, customers, suppliers, service and even liquidator.

At the outset, the company should focus on mastering their own vertical communication. Product digitization and digitization of all processes associated with the creation, production, distribution ... This means the generation of data in every situation and condition whenever something wrong with the product, both during the design or production or supply. In doing so, the data flow by a continuous, fast processing, and based on their evaluation are made and follow-up measures. This is the basic principle called "digital twin". The existing physical production is produced by a physical product. Digital twin has created a virtual model of the product and production. The collected data from the production are evaluated, thereby gaining the knowledge generated good practices, and these are used to optimize products and production processes. The concept of a company should be based on the setting of unified data base, managing product data and manufacturing processes.

Such base is the PLM systems. PLM - Product Lifecycle Management systems manage the entire lifecycle of a product from its inception, through design and manufacture through use to disposal. PLM integrates people, data, processes and business systems, and data is the backbone

of a product intended for all corporate structure and expansion of the company. As the definition it implies linking all PLM processes and data associated with the product. Industry 4.0 work with the data generated in the PLM systems when we look at it from the perspective of data, it is a system focused on management and data management. In them they create digital product models and production processes and re-collects data from production. They include systems designed for product design, CAD (Computer Aided Design) / CAE (Computer Aided Engineering) and systems designed to draft production systems, production and logistics processes, processing technology, CAM (Computer Aided Manufacturing) and Digital Manufacturing systems. It is creating a basis for all further communication links with Industry 4.0. Today are used the following ways of programming for the preparation of CNC programs:

- teach programming,
- manual programming by the help of ISO G codes,
- automatic programming using programming languages,
- automatic programming using CAD/CAM systems [1],
- shop floor programming,
- macro programming [2],
- step programming .

The mode of the program production for a concrete component is affected by:

- the shape of a component itself,
- hardware and software design level for programming,
- operator's prior experience and skills,
- the type of the control system of a CNC machine, the technical equipment of a CNC machine [3].

Popma used in the field of high-speed machining Computer Aided Process Planning for high-speed milling of thin-walled. This approach and concepts have been implemented into software, based on an existing feature based, knowledge-based CAPP package. The core steps of planning volumes to remove, how to machine them, and in which order, have been automated in a knowledge based way. Also supplementary software utilities and functionality have been implemented. From evaluation of the resulting application for industrial practice, the automatic determination of the machining sequence for thin-walled geometry and the improved overview of the process plan were considered great benefits [4].

Computer-aided manufacturing (CAM) is use of computer software to control machine tools and related machinery in the manufacturing of workpieces. Most machining progresses through four stages, each of which is implemented by a variety of basic and sophisticated strategies, depending on the material and the software available [5].

The stages are:

- Roughing: This process begins with raw stock, known as billet, and cuts it very roughly to shape of the final model. In milling, the result often gives the appearance of terraces, because the strategy has taken advantage of the ability to cut the model horizontally. Common strategies are zig-zag clearing, offset clearing, and plunge roughing, rest-roughing.
- Semi-finishing: This process begins with a roughed part that unevenly approximates the model and cuts to within a fixed offset distance from the model. The semi-finishing pass

must leave a small amount of material so the tool can cut accurately while finishing, but not so little that the tool and material deflect instead of shearing. Common strategies are raster passes, waterline passes, constant step-over passes, pencil milling.

- Finishing: Finishing involves a slow pass across the material in very fine steps to produce the finished part. In finishing, the step between one pass and another is knowledge compilation, and achieved good results. Feed rates are low and spindle speeds are raised to produce an accurate surface.
- Contour milling: In milling applications on hardware with five or more axes, a separate finishing process called contouring can be performed. Instead of stepping down in fine-grained increments to approximate a surface, the workpiece is rotated to make the cutting surfaces of the tool tangent to the ideal part features. This produces an excellent surface finish with high dimensional accuracy. The first commercial applications of CAM was realized decades before. It was in large companies in the automotive and aerospace industries, for example UNISURF in 1971 at Renault for car body design and tooling. The output from the CAM software is usually a simple text file of G-code, sometimes few thousands of commands long, that is then transferred to a machine tool using a distributed numerical control (DNC) program [6].

2. Dimension of component

Figure 1 shows dimension of thin walled component in graphical environment Creo 2.0. Component was made of duralumin ENAW2007, has shape is symmetrical with respect x and y axes to**.**

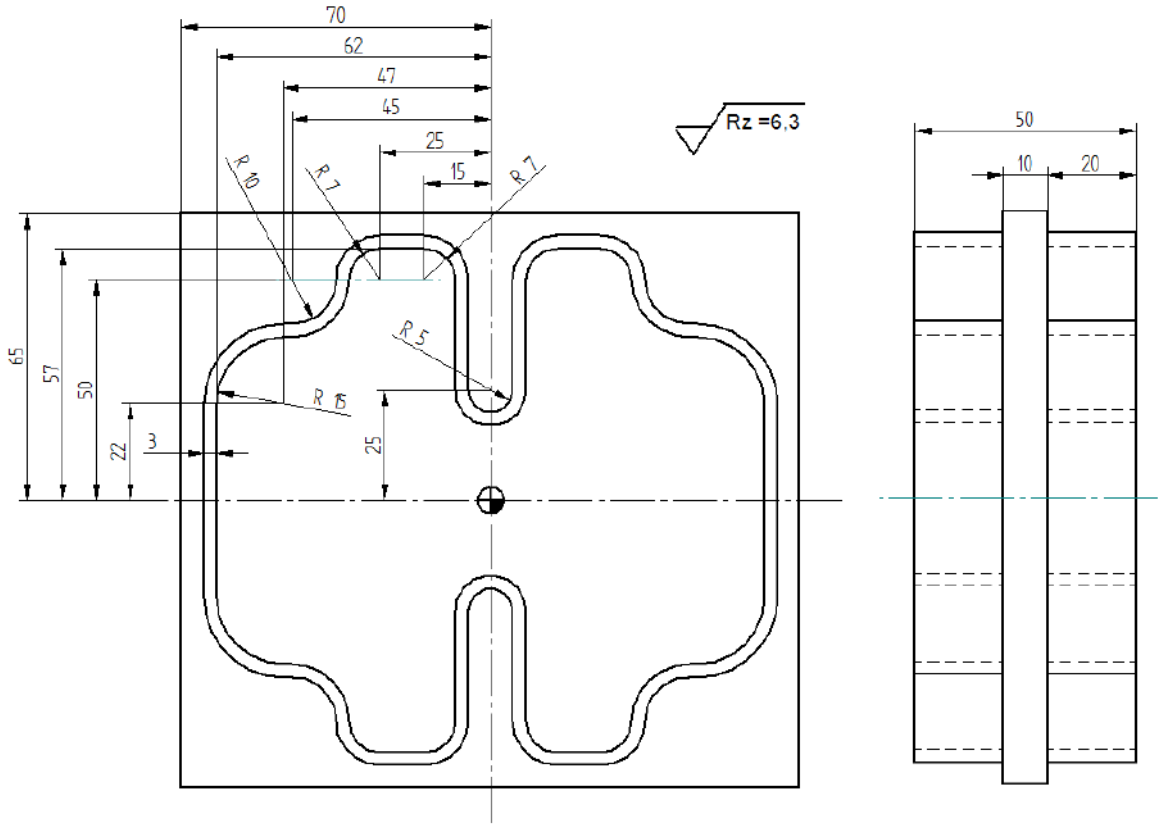

Figure 1: Dimension of produced component in graphical environment Creo 2.0.

3. Component modeling in CAD software products

CAD model of part was created using software Creo Parametric 2.0, with use of features like Extrude, Removal Extrude, Round, Edge Chamfer. Modeling in WorkNC would be realized with use of same features and operations with various cutting tools [7]. CAD model of part was saved in STEP (*.step) format. Environments of different CAM software solutions are showed on further figures. Localization zero point in graphical environment Creo 2.0 we see on (Fig.2) and analysis of the angles on the model in graphical environment Work NC we see on (Fig.3).

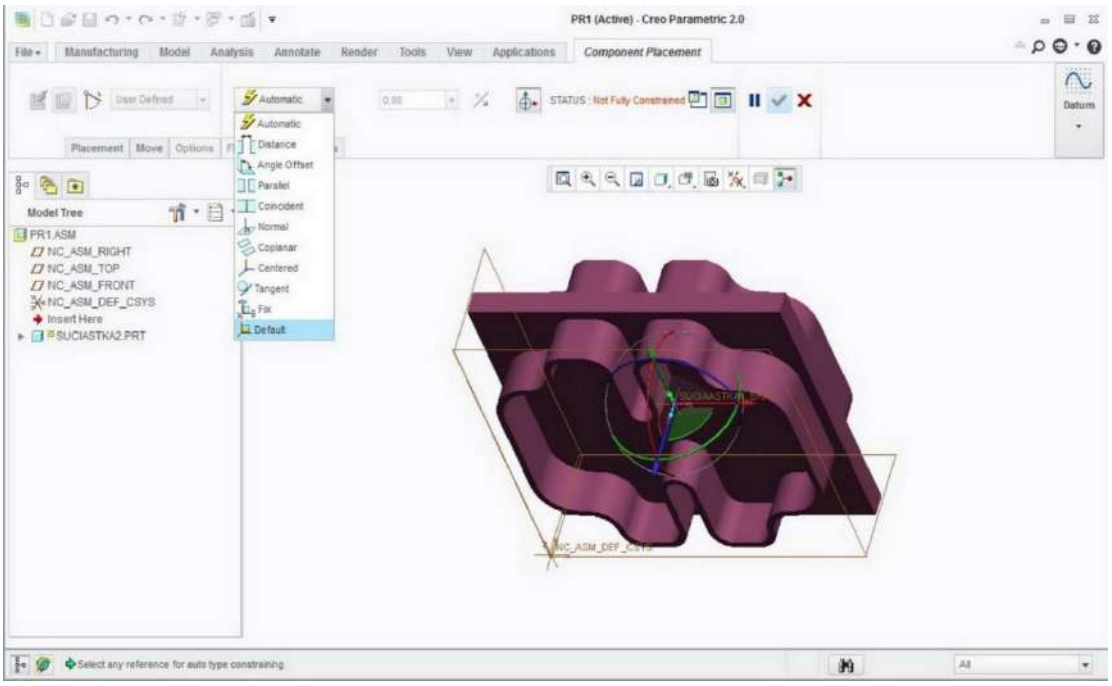

Figure 2: Localization zero point in graphical environment Creo 2.0.

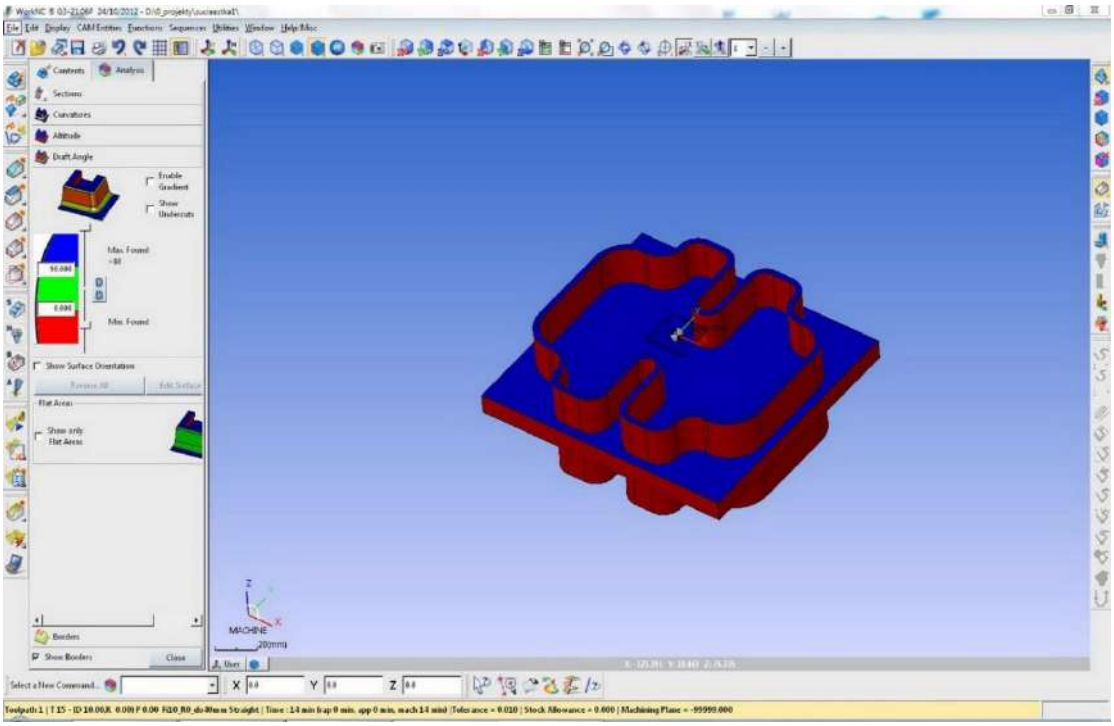

Figure 3: Analysis of the angles on the model in graphical environment Work NC.

4. Comparison and evaluation of creating of CNC programs with use of different CAM software

Prior to comparison of creation of CNC programs in environment of different software solution it is necessary to determine the categories and values that will be observed, measured and compared in order to make the final result objective and true.

With this paper following values were selected for evaluation purposes:

- Number of mouse clicks while programming the particular operations,
- Time necessary for programs creation and completion of particular technological operations

4.1. Number of mouse clicks while programming the particular technological operations

While setting particular technological operations and cutting conditions it is necessary to use the mouse clicks many times for selecting of actions, orders. Figure 4 provides information on total click amount for selected technological operations.

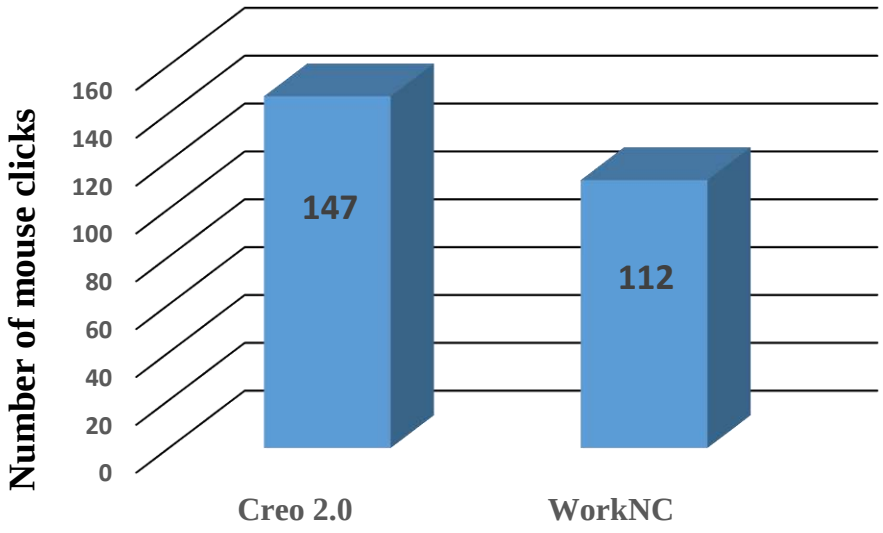

Figure 4: Total click number for necessary for creation of CNC program.

For measuring of click count there were the same conditions set in all programs, for example also the initial clicks for software starting and environment getting ready were counted as well as clicks for creation and saving of part model. Figures 5. shows the selection of the postproces in WorkNC. In the figures 6. we see selection operation roughness in Creo 2.0.

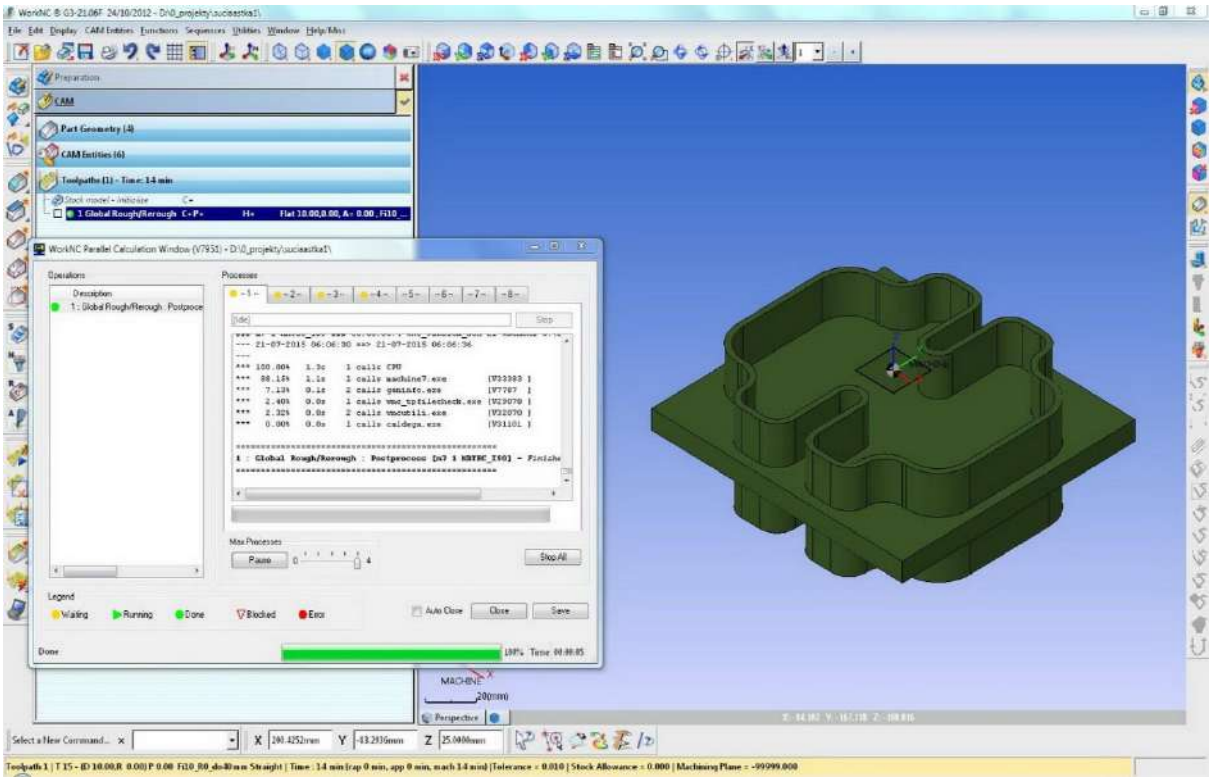

Figure 5: Selection post process in WorkNC.

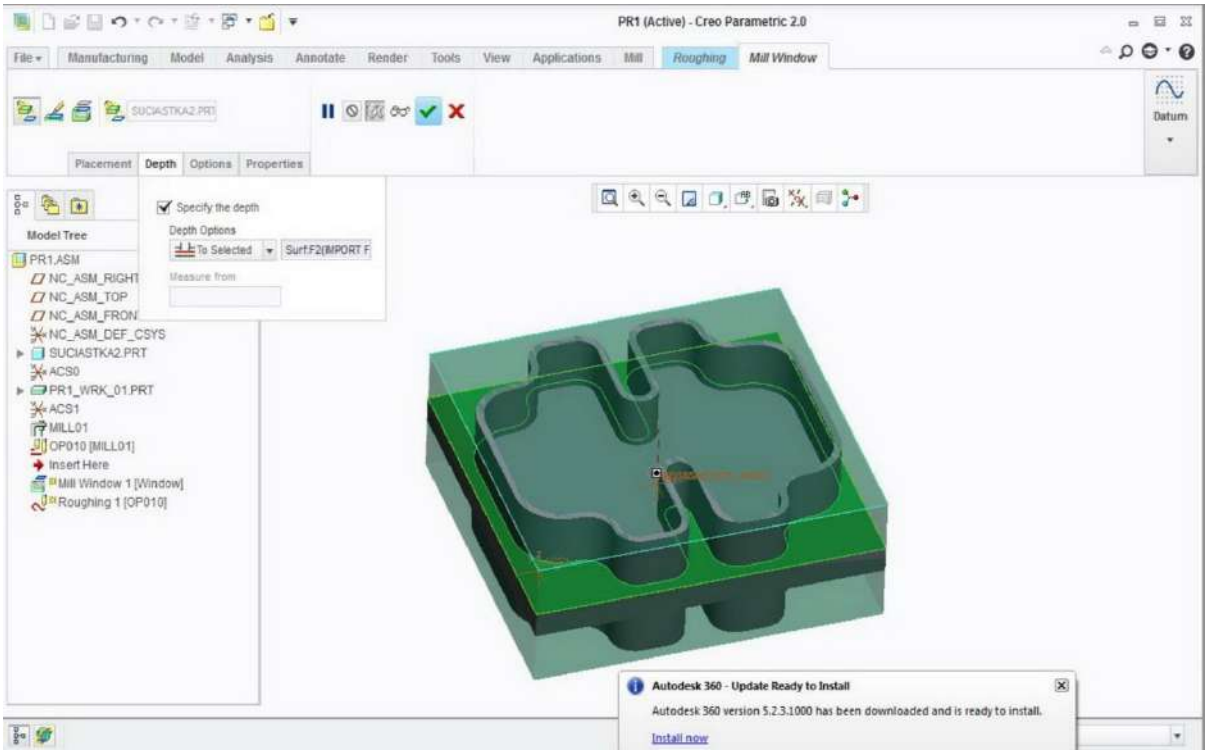

Figure 6: Selection operation roughness in Creo 2.0.

4.2. Time of model creation

Measuring was started with first click on the icon of the program and stopped with complete and usable NC program created. Time measuring was realized between first and last mouse

click. Figure 7 shows total time necessary for part programming in seconds. Shortest time of model creation was measured for WorkNC G3 21.06 thanks to low number of necessary clicks. Second place took Creo 2.0 where the program creation took almost 3 minutes mainly because of complicated use of working windows.

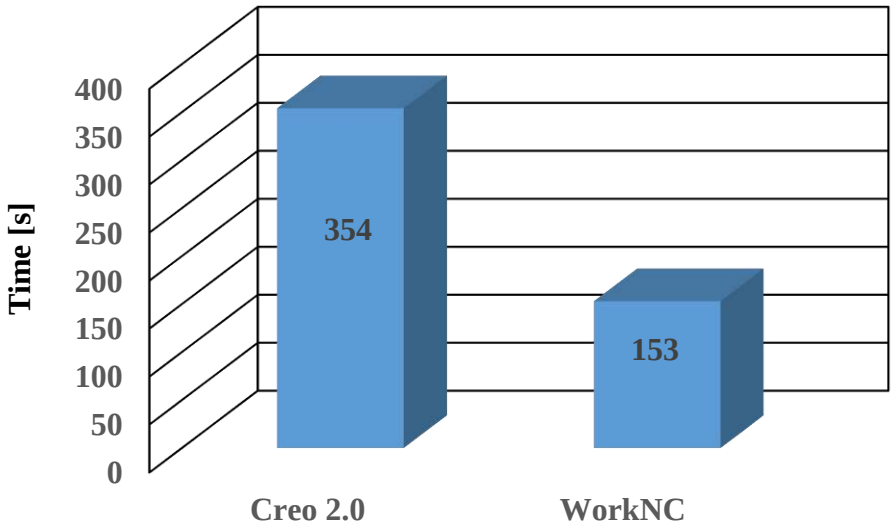

Figure 7: Total programming time for Creo 2.0 and WorkNC.

After generating of CL data and handling them with postprocessor they were inserted to control program of CNC machine with various control system [8]. Following manufacturing itself. It may be machining, Hadfield steel [9], composite material [10] for various roughness of surface [11], various measuring systems [12] for surface geometry [13]. Figure 8 shows play path in graphical environment WorkNC and in the figure 9 we see simulation manufacturing of component in Creo 2.0.

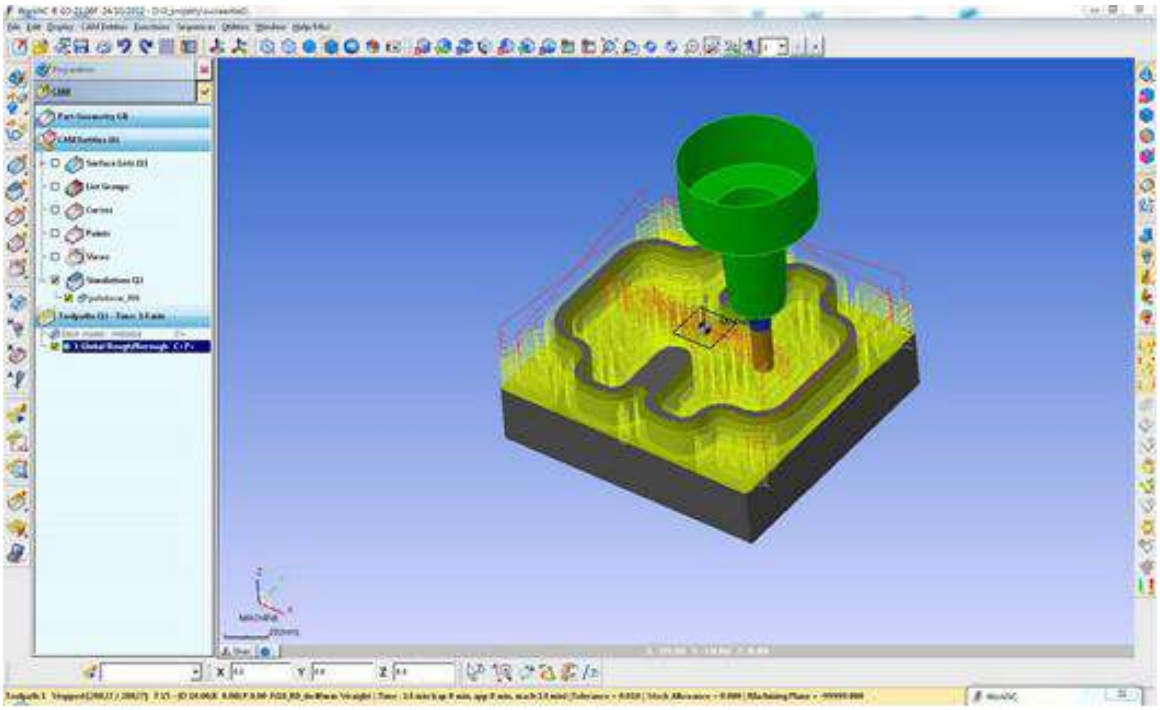

Figure 8: Play path in graphical environment WorkNC.

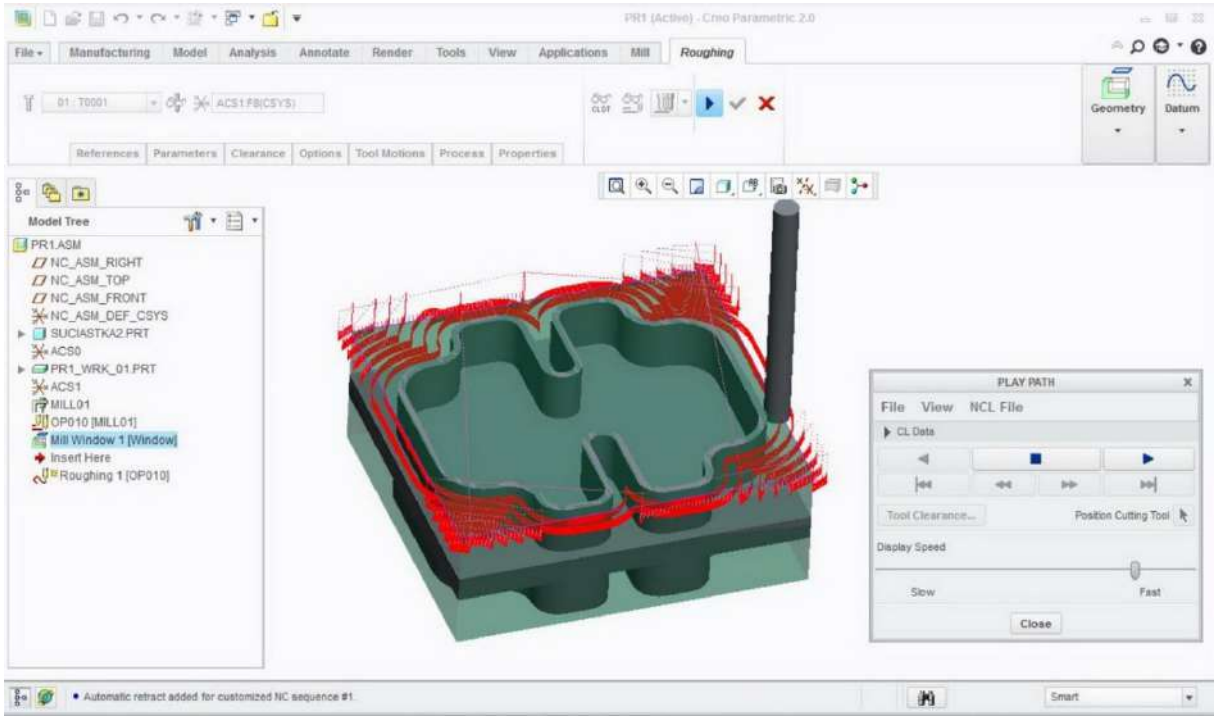

Figure 9: Simulation manufacturing of component in Creo 2.0.

5. Results

Selected were base PLM systems for lifecycle of product from its inception, through design and his manufacture. Generated were dates for digital model of product for digital production process. Designed were two CAM software products Creo 2.0 and WorkNC. Compared were number of mouse clicks a time for programming production for component.

6. Discussion

The kind of CAM software product was selected by the shape of a model component itself.

Both CAM software products serving a programmer who their perfect command. Differences in the number of mouse clicks and times have been recorded in comparison with software products, Autodesk Inventor Professional 2016.

7. Conclusion

For the manufacturing environment is increasingly complex. The need for CAM and PLM tools by the manufacturing engineer, NC programmer or machinist is similar to the need for computer assistance by the pilot of modern aircraft systems. The modern machinery cannot be properly used without this assistance. Today's CAM systems support the full range of machine tools including: turning, 5 axis machining and wire EDM. Today's CAM user can easily generate streamlined tool paths, optimized tool axis tilt for higher feed rates, better tool life and surface finish and optimized Z axis depth cuts as well as driving non-cutting operations such as the specification of probing motions. Program presenting the best solution here can change according to the change of criterion – time, working style, geometrical shape of part. Most suitable seems to be WorkNC mainly because of shortest click amount of button about 35,and programming time shortest about 201second.

Acknowledgments

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Technological Differences and Productivity of Czech Logistic Firms

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Abstract: The paper analyses logistics industry in Czechia and analyzes clusters and groups of 100 firms active in the market in 2014. Analysis is based on the economic theory of endogenous growth and technological spillovers of multinational firms. They have the knowhow and technology which makes them more productive than local firms which tries to catch up the leaders and try to get as much knowledge as possible. This paper contributes to this theory. Key findings for this transitional economy are (1) the quality dilemma is present and quality certification is not beneficial for labor productivity and earnings, (2) there are differences among multinational firms in terms of output efficiency and they are on average more productive than local firms, (3) older firms are less productive than younger, but entrants are not more profitable than older firms.

Keywords: Multinationals, certificates, convergence, entrants, logistics.

1. Introduction

The paper analyses logistic firms in the Czech Republic in 2014 and tests hypotheses about endogenous growth theories. Logistic firms are important in transferring information between businesses and they are also essential part of the technological spillovers network. This paper explores this rather unique industry and its total factor productivity. Clusters and groups of firms in the market are analyzed. Usually, as economic theory predicts, foreign firms have the knowhow and technology which makes them more efficient. We can say that they have the competitive advantage which allows them to gain higher earnings and appropriate more from their innovations which they brought form their home country. Local firms are so called imitators and tries to catch up the leaders (they bring innovations new to the regional market) and innovate (they invest in innovation new to the firm) and try to get as much knowledge as possible. To do that they, for example, standardize their processes using ISO certificates, spend more on research and development etc. There are also so called spin-off firms, young companies which are using modern technology and usually rather higher risk market strategies.

This paper explores and test hypotheses about those technological and strategical differences between certain groups of logistic firms in the Czech Republic in 2014. These hypotheses are built upon the endogenous growth theory which emerged in the 1980s [1] as the neoclassical economic theory and became milestones of mainstream economics. Since then many competing approaches [2,3] are implementing microeconomic concepts and more interestingly historical context [4] and aim at the complexity of economic activities [5]. These theories are broadly tested at the firm level [6] where the information and knowledge is amplified.

In Logistics industry major changes occurred since 1990s and the boom of the internet and fast development in communication technology. The Global Value Chain companies are networks dependent on efficient logistics [7] and old methods [8] as well as new methods [9] are employed to provide direct assistance and practices of Total Quality Management and efficient Just in Time management. The main goal in logistics is to set up long-term contracted relationships where information and knowledge flows have significant effects on productivity

on participating companies [10].

Collaboration and networks where information flows is thus also possible thank to logistic industry. It is not coincidence that many so called pull factors (information sources) and push factors (technology, society needs) of innovation come from this industry [11]. Logistics industry enables flows of information and knowledge. On average, these strategic information flows positively impact management of assets, costs of operations, and productivity [12]. These flows are also called spill-overs [13] which can be based on more information and knowledge flows in the logistics industry. The final technology or innovation incentive is a mixture of innovation push and pull factors which are in the market. Foreign direct investments are one of the factors of technological change. It is not an exclusivity of former state planned economies like the Czech Republic but in transitional economies the positive productivity spillovers from foreign direct investment are stronger [14] and also small and entrant firms with low productivity benefit from multinational presence [15].

This paper is aimed at three groups of firms in logistic industry. First group are foreign firms which have the knowhow and technology. They are more efficient and equipped than local firms which are so called imitators and try to catch up the leaders. Usually local firms are then seen as innovators because they are introducing new to the firm and sometimes new to the regional market innovation. They are pushed by new technologies and pulled to innovate by their clients and they invest in innovation projects and try to get as much knowledge as possible. We expect foreign firms to have higher sales [16, 17] and their contribution to technological spillovers [18].

With spillovers and competition pressures deals our second group of firms in logistics industry. Relatively younger firms are usually some kind of spin-offs and we can expect them to be technologically well equipped firms. In our sample they are firms which were established in 2010 and are six years old. The selection of 6 years was based on practical reasons, i.e. on the number of observation necessary to estimate unbiased differences. We expect younger firms to be more efficient because the entrepreneurs were able to gain experience (from spillovers, from being employed in multinational etc.) in the period of 1989-2009 (a transformation period).

Third group aims at quality and targets at premium services. To do that they standardize their processes using international certificates (ISO 9001). Many papers came to the conclusion that we can see in history that quality certifications help improve the management of logistics processes [19] and on average ISO adopters had higher growth rates for sales [20]. But in logistics there is a dilemma which makes this quality adoption strategy problematic. Many whole trade and manufacturing firms are deciding to outsource logistics services. The decision to select a provider is based on quality, time efficiency and costs. Many seeks high quality, low cost time efficient solutions but as always only two criteria are satisfied which makes this dilemma an issue. For logistics industry there are results suggesting long term positive effects on financial performance for logistics providers which adopted quality certificates [21] but the productivity issue and comparison to lower quality competition is still unresolved.

Current research is aimed at precise case studies of small sample of firms [22] and rather than productivity we can see data envelopment analyses aimed at technical or operational efficiency [23] or sustainable financial health [24]. This paper is using rather basic econometric methods to evaluate three hypotheses about certain group differences in logistics industry in the Czech Republic in 2014.

2. Methods

Data comes from the Business database provided by MagnusWeb which is a representative database especially for the year 2014 in comparison to other commercial database products. There are 100 observations of firms in logistics industry (NACE 52), and firms with empty observations in sales and fixed assets, firms with zero employees and 1 firm in the process of liquidation and one firm in the insolvency were deleted (Table 1). On average there are 28 % foreign owned firms (more than 50% share). There are young firms as well as firms established after the fall of the Communism in 1989 and average firm's age is around 12 years. Other financial indicators vary a lot and we can observe heteroscedastic data sample.

Table 1: Summary statistics of logistic firms in the Czech Republic in 2014.

Variable	Mean	Std. Dev.	Min	Max
Firm's age	11.58	6.18	2	25
Number of employees	87.74	179.00	1	910
Foreign ownership	0.28	0.45	0	1
Certificate ISO 9001	0.20	0.40	0	1
Fixed assets	2.85e+08	1.65e+09	12000	1.53e+10
Sales	1.90e+08	3.98e+08	798000	2.59e+09
Earnings before tax	2.15e+07	1.20e+08	-4.33e+07	1.08e+09

Source: MagnusWeb database

A standard production function (Equation 1) model was used for the production analysis [25]. The estimation is based on standard ordinary least square method. Because of heteroscedasticity the robust standard error is used to correct for estimation bias of beta coefficients. To test the specification of the model the Ramsey Reset test[26] is used and the F statistics is reported. Because of the dummies in the estimation the baseline firm is a national firm without certificates.

$$y_i + \omega \cdot X_i + \gamma \cdot Controls_i + \upsilon_i \quad (1)$$

In the Equation 1 the $\omega \cdot X_i$ represents the vector of basic components of the production function (fixed assets, number of employees), the expression $\gamma \cdot Controls_i$ is a vector of control variables (ownership, age, certification) which augments the production function, and υ_i is the error term. The Cobb-Douglas function requires logarithmic transformation and there is known limitation of this approach, for example the assumption of perfect competition in the production factor markets and endogeneity between sales and assets.

This cross-sectional data sample (Table 1) is analyzed. The use of standard unpaired t-test would offer possibly biased results because data are not normally distributed. The two sample equality hypotheses were therefore tested by the Wilcoxon rank-sum test [27]. It is an unmatched data equality test of two independent variables: X_1 (for example the group of entrant firms) and X_2 (the firm's earnings).

The rank-sum test is reflected in the single z-test Wilcoxon statistics, which tests the null hypothesis of equality on a sample of n observations. The probability of Type I error was chosen to be α=10 % ($p < 0.1$). The mean difference between the groups is used as a rough approximation of dissimilarities under ceteris paribus condition. Multiple variable interactions were not allowed.

3. Results

Regression results suggest that there are differences between firms (Table 2). The entrants, the younger firms, in the sample are more effective and have higher sales and labor productivity than older firms. This productivity differences is approximately minus 4.1 % in comparison to a one year younger firm. This is somehow in line with economic theory and pressures of market mechanism, competition and theory of spillovers because in our sample there are only active firms which are not facing bankruptcy (at least the analyzed year).

According to some economic theories of endogenous growth the foreign owned firms are bearers of technological progress especially in the transition markets. We can observe higher (plus 56.8 %, beta is 0.45*) productivity of foreign owned firms in comparison to base line local firms but we can see also that there is a high variability and heteroscedasticity in the results. Finally, the firms' orientation at quality is not reflected in higher productivity or amount of sales in comparison to firms without certificates.

Table 2: Results of the production function in the logistics industry in the Czech Republic in 2014.

Total factor productivity	**(1)** **Sales**	**(2)** **Productivity**
Number of employees (LN)	0.707***	-0.191***
	(0.08)	(0.07)
Fixed assets (LN)	0.102**	
	(0.05)	
Quality certificate ISO 9001	0.431	0.431
	(0.29)	(0.29)
Firm's age	-0.041***	-0.041***
	(0.01)	(0.01)
Foreign ownership	0.450*	0.450*
	(0.23)	(0.23)
Fixed assets per employee (LN)		0.102**
		(0.05)
Constant	14.178***	14.178***
	(0.70)	(0.70)
Observations	100	100
Adjusted R^2	0.670	0.180
Ramsey RESET test	F=1.30	F=1.99

Note: Robust standard errors in parentheses, * p < 0.10, ** p < 0.05, *** p < 0.01

4. Discussion

This analysis has its limitation and a panel of logistic firms would be better at capturing within firm variation which would describe the situation in longer time period. In this paper a robustness analysis of previous results is tested using ANOVA and different dependent variable which is standard profit indicator earnings before taxes (EBT).

The results are not completely in line with current empirical research in logistics industry [22, 23]. The dilemma of quality, time and costs is amplified in the Czech Republic, which is located in the center of Europe and is one of the strategic countries for logistics industry.

The quality orientation hypothesis is again rejected. This strategy as the results suggest is not a strategy of higher productivity or profit. The EBT differences between group national and foreign owned firms are substantial and national firms have on average 63.4 million CZK lower EBT than foreign owned firms. But again we can observe high variability inside foreign owned firms. This result suggests that there are certain characteristics of multinational firms which we are missing like market orientation or local competition.

Table 3: Earnings differences in the logistics industry in the Czech Republic in 2014.

Group	**Observations**	**Means**
Without ISO	80	2.37e+07
ISO	20	1.27e+07
z=-2.654***	Difference	-1.10e+07
Group	**Observations**	**means**
National	72	3755889
Multinational	28	6.72e+07
z=-1.869*	Difference	-6.34e+07
Group	**Observations**	**means**
Older (7+)	72	2.26e+07
Entrants (1-6)	28	1.91e+07
z=1.539	Difference	3528764

Note: * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

The analysis of differences suggests that entrant firms are not more efficient. The difference in EBT is relatively small. But we have to perform more detailed technical input output efficiency analysis to account for possible cost structure of relatively younger firms.

5. Conclusion

This paper contributes to the theory of technological spillovers. The results suggest that technological differences according to economic theory are present. But in this transitional economy we can observe the quality dilemma. The ISO 9001 quality certification is not beneficial for labor productivity and earnings. This result is contra intuitive and suggests either high competitive pressures to lower costs or ISO 9001 certificate to be unsuitable for this industry and is not demanded by clients and partners in supply chain. But these questions are yet to be answered.

There are also some differences inside the sample of multinational firms in terms of output efficiency (high variability and large estimation error) and they are on average more productive than local firms. Older firms are less productive than younger, but another analysis suggests that entrants are not more profitable than older firms. This suggests the ability to enter the market and survive with the ability to appropriate the gains from initial investment. In other words startup costs are reducing earnings before taxes but firm is able to take over a substantial market share. Logistics industry is a net of connected companies which is essential for technological transfer and multinational firms are leaders which influence the market and its technological level.

Acknowledgments

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Support for Flood Prevention in the Territory of the Czech Republic

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Abstract:

This post deals with the realization of technical flood protection measures, in particular the effective preventive measures in the flood control in flood areas. Will be preferred that measures aiming to increase retention, therefore, measures it controlled rozlivům flood, polders, water tank with those areas. In particular, will be supported under the measures in areas with a potentially significant flood risk as defined by the so-called. flood directive of the European Union.

Keywords: Implementation of flood control measures, increase retention, measures to controlled spills, flood.

1. Introduction

The objective of this stage is the implementation of technical measures in the flood control in the years 2014-2019 and especially effective preventive measures of flood control in flood areas. Will be preferred to measures aiming to increase retention, therefore, measures to controlled spills of flood, polders, water tank with those areas. In particular, will be supported under the measures in areas with a potentially significant flood risk. In the early years of the programme in the context of the proposed subprogrammes to ensure planning for major construction flood control measures, whose preparation is time consuming and financially demanding. In the following years then assume the start of other subprogrammes, in the framework of which the flood protection measures implemented.

In the period 2014-2019 is planned to finance the expenditure for the implementation of flood control measures in construction subroutines from the State budget in the amount of 4 500 miles. Minimum of CZK 546.083 million. CZK will ensure that applicants from its own resources.

Figure 5: Top view (Source: Ministry Of Agriculture)

2. The history of flood prevention

On the territory of the Czech Republic leads to spill of water out of the trough of water flows in flood situations, with a 1% probability of occurrence (the so-called hundred years ' of water) to the total area of 2 481.9 $km^{2\ of}$ territory around the waterways, an area of 1 km^2 303.4 is protected in different ways to the more frequently occurring flood.

For the emergence of the floods in the Czech Republic are in most cases crucial meteorological phenomena whose consequences of causation are reflected directly on the territory of the state. Floods coming from the neighbouring countries may occur in significant quantities only on the river Dyje and partially on top of the Lužnice River. Significant is the threat to the territory of the Czech Republic as a result of the flood situation on the Ohre River tributaries from the territory of Germany and on the Olza River and tributaries of the Stěnavě from Poland. In addition to meteorological phenomena is to flood the second main determining factor and method of utilization and management of land in the various river basins.

For the past 19 years that have passed since the extreme floods in Moravia in 1997, caused floods in the Czech Republic for more than 190 billion. and mean the loss of 135 lives.

After the flood disasters in the years 1997 and 1998 was adopted in April 2000, the Government of the Czech Republic, "the strategy of flood protection for the territory of the Czech Republic." Subsequently, by resolution of the Government of 13 April. in September 2000 the "intentions of making prevention programmes before the flood" was launched, the preparation and implementation of preventive flood protection measures in the framework of the programme funding.

Floods since 1997 in terms of loss of human lives and the amount of flood damage.

Table 1: Flood situation

Flood situation (year)	The number of losses of human life	Flood damage (mil. CZK)	
		total	It works on the VH property
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
A total of	**135**	**189 600**	**21 162**

Source: Ministry Of Agriculture

3. The basis for the continuation of the implementation of flood prevention measures

The basic legislative document for the management of flood protection is Act No. 254/2001

Coll. on waters, which addresses the measures to prevent and avoid damage during floods, defines the flood authorities and other participants of the flood protection and their obligations.

Constraining factors in the implementation of flood control measures may be ownership to land under the future water or in flood the proposed polders.

Building on the framework directive on waters was taken in the EC Directive of the European Parliament and of the Council of 23 October 2000. October 2007 on the assessment and management of flood risks, which was transposed by an amendment to the Act on waters no 150/2010 Sb. the purpose of this directive, a framework has been established for the evaluation and management of flood risks in order to reduce the adverse effects on human health, the environment, cultural heritage and economic activity associated with floods.

In the plane of the strategic documents is possible to conclude, that already in the year 2000, the Government of the Czech Republic approved the "strategy for flood prevention on the territory of the Czech Republic." Her refinement includes "plan main river basins of the Czech Republic" (2007) and concrete measures "the plans of the river basin district" (2009).

4. Objectives of the programme, monitoring and final evaluation

The aim of the programme is to increase the degree of flood protection through the establishment of new retention areas, modifications to existing reservoirs and retention effect, the realization of the polders and the measures for spills of river basin and the polders and the construction of flood measures along watercourses by the construction of dykes and the capacity increase and stabilization of the troughs of the waterways. They will be supported by measures derived from the design of cities and municipalities. Missing will be preferred to measures in areas with a significant flood risk.

The basic prerequisite for inclusion in the programme of action is the submission of the application. Sources in the financial proposal assumes the involvement of the investors ' own resources in the amount of at least 5-10%. The aid shall be fixed at a maximum of 95% of the costs for the State-owned enterprises.

The Ministry of agriculture as an administrator of the programme will carry out control activities in the management of funds of the State budget in the phase of preparation, implementation and evaluation of the programme and individual actions.

An evaluation criterion for the provision of financial resources will be the effect on risk reduction of the impacts of the floods and the economic efficiency of the resource.

For the assessment of flood control measures will be used "methodology – support for flood prevention", processed by the Department of hydrotechnique Building of the Faculty of the Czech Technical University in Prague.

The final evaluation of the action will be carried out in accordance with Act No. 218/2000 Coll. on budgetary rules and amending certain related laws.

To the final evaluation of the action program participant shall submit a report, which will contain the conditions laid down by Decree of the Ministry of finance.

References

[1] The Ministry of Agriculture of the Czech Republic

Vehicles Safety Improvements at Railroad Crossings

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1. Introduction

Railroad crossings and roads infrastructures is a critical point of both infrastructures with a high degree of safety risk. We are constantly looking for different ways of additional direct security signaling/marking, but also legislations that would have changed this unfavorable situation.

The rise in road traffic density associated with the degree of carelessness of drivers also significantly negatively affects the statistics of accidents at railroad crossings. Unfortunately the statistics also show the increase of collisions of buses that are transporting greater number of people, also trucks that collide at level crossings. Modern information and communication technologies, together with increasing vehicle intelligence allow you how to deal with these situations and increase in the safety.

Therefore the Ministry of the interior Cz has commissioned a project to enhance the security situation on at the levels at the roads and railway crossings. The project was called "enhancing vehicle safety in the transport of passengers and freight at the critical points of the infrastructures". The principal researcher was the company KPM CONSULT Brno a.s, with the co-researchers of CVUT field of transportation and research center in Brno.

2. Methods

The main objective of the solution was:

- *To pass information in good time of the approaching railway vehicle to a road vehicle.*
- *Analyse existing legislation and draft modifications of existing legislation.*
- *Technical design solutions for crossings secured with warning crosses only, but also for*
- *Crossings that are already secured with light crossing security devices.*

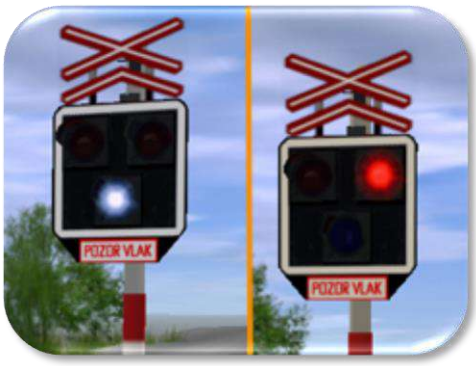

Fig. 1. Light crossing devices

Fig. 2. Security level crossing warning cross

The system is designed as a warning system that is supposed to be an additional warning information for drivers of vehicles. The priority of that is to focus on the professional road users who are legislatively and legally monitored/controlled. This is in particular the drivers of

vehicles carrying dangerous materials or a large number of people (buses). Preconceived system function is to provide warning information about the state of the railway level at the same crucial moment when crossing vehicle and the train is approaching the intersection.

1. System design

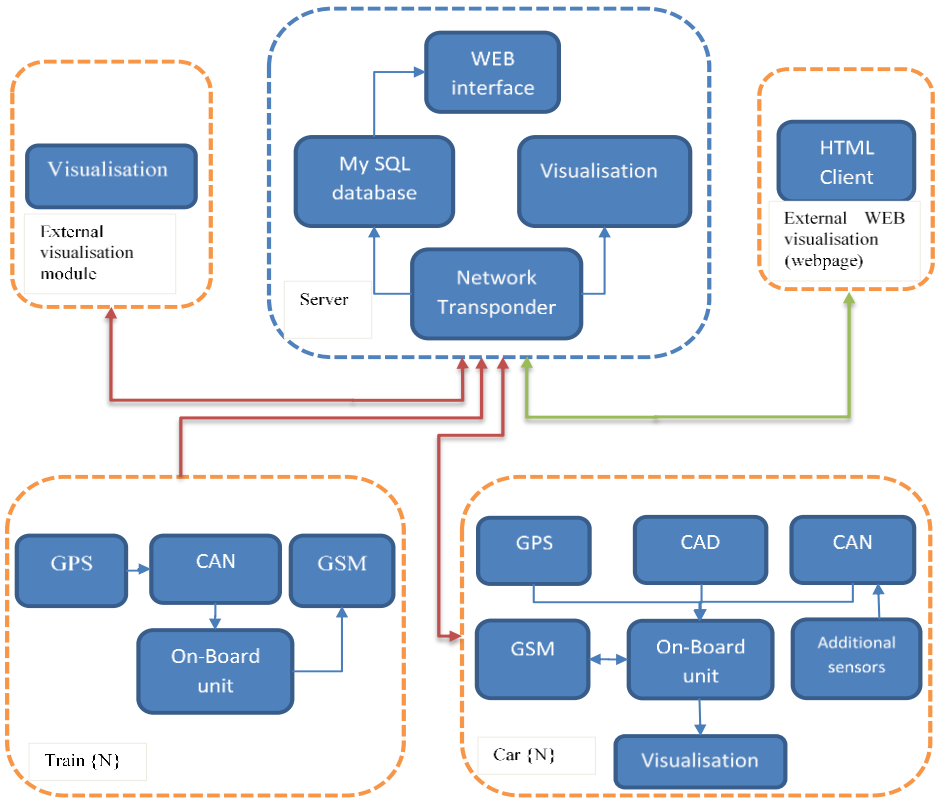

Fig. 3. System design

The system consist of two basic parts.

A) Stationary parts, that contains:

- Server with fixed IP address connection.
- The system of "smart tags" that contains a receiver and a transmitter (located at the pipe of the warning sign before the crossing).