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UTILIZATION OF ”GREEDY“ALGORITHM OF THE SHOPPING CENTER OPERATION

Miroslav FAZEKAŠ, Ondrej STOPKA, Marián ŠULGAN

1 Introduction

Calculations based on the compilation of algorithms may be included as a part of the significant field of use of mathematical calculations for the optimization and Operations Research of traffic problems. Generally, these calculations relate to the distribution of goods from source (sources) to the scattered destinations. One of the possibilities for solving the traffic problems is the use of the “Simplex method”.

This example deals with the special group of traffic problems which can be called as “shuttle traffic problems”. The goods must be delivered from the supply warehouse S_0 (for example cross-dock warehouse) to the selected customers, the shopping centers placed in the area of the city of Žilina in our case, ($S_1, S_2, \ldots, S_n$), which are supplied one by one [1], [2].

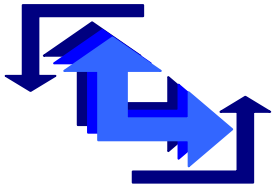
Let d_i denotes the distance between S_0 and S_i and the determination of the optimal supply sequence which minimizes the total waiting time of customers for supplied goods is the target problem [1], [2].

This particular example relates to the typical “shuttle traffic problems”, which means that the individual problems depend on the total waiting time of customers.

2 Analysis of the utilized logistics solutions for supplies

The hypermarkets supply utilizes four types of goods supply [3]:

a) direct – the goods is supplied directly to the customers,
b) cross – docking – the goods is not stored (system of immediate goods reloading),
c) central warehousing – supply from one or more central warehouses,
d) direct full truck loads – the goods is supplied to the customers in full truck loads.



Cross-docking

Nowadays, cross-docking is more and more used type of the storage systems. It represents the immediate goods reloading from the place of goods input through the warehouse directly to the place of goods expedition. It is one of the many techniques in the supply chain which aims to reduce the inventory, improve the space utilization and increase the efficiency of equipment used to supply.

Cross-docking technique is also known as "bulk with order", "pick to zero", "pick by line" and "over the bank". It includes the unloading the partially assembled products for integration with other key orders prior to the next delivery to retail stores.

Enterprises that meet at least two of the following criteria should consider the introduction of the cross-docking system [3]:

- after the receipt of goods in the warehouse, its destination is already known (for example the hypermarket department),
- customers are ready to take the goods immediately,
- daily, the goods supplies are distributed to less than 200 localities,
- the enterprise receives a large number of items,
- received goods is already marked (tags or codes),
- certain kinds of goods are time sensitive items.

3 Simple Shuttle Problem

The operation of shopping centers with one vehicle from one CROSS-DOCK warehouse

The essence of a "simple shuttle problem" is to minimize the customers total waiting time for goods

$$\sum_{i=1}^{n} t_i \qquad (1)$$

where t_i *waiting time of the customer* S_i

It is assumed that carriage of goods between S_0 - supply (cross - dock) warehouse and the customer S_i is carried out by one vehicle and also that the vehicle returns to the starting warehouse S_0 after the supply of goods.

For constant vehicle speed, waiting times t_i may be replaced by the traveled distance d_i between the starting supply warehouse and the individual customers S_i [2].

$$
\begin{aligned}
t_1 &= d_1 \\
t_2 &= t_1 + (d_1 + d_2) = 2d_1 + d_2 \\
&\vdots \\
t_n &= t_{n-1} + (d_{n-1} + d_n) = 2d_1 + 2d_2 + \ldots + 2d_{n-1} + d_n
\end{aligned}
\qquad (2)
$$

where d_i *traveled distance between the starting supply warehouse and the customer* S_i

In order to substitute the values d_i to the formula, it is necessary to determine the actual distances between a particular cross-dock warehouse (potential warehouse is located on the P. O. Hviezdoslava Street - the premises of the railway station) and the individual shopping centers in the city of Žilina. These distances are shown in the following *Table 1*.

Tab. 1 *Distances between the cross-dock warehouse and the individual shopping centers in the city of Žilina*

S_i	S_1	S_2	S_3	S_4	S_5	S_6	S_7	S_8	S_9	S_{10}	S_{11}	S_{12}	S_{13}	S_{14}	S_{15}	S_{16}
d_i [km]	1,2	1,1	2,3	3,6	1,0	3,2	1,8	5,9	2,2	4,7	1,6	1,0	3,4	3,3	2,9	5,3

Source: Authors

The next step in the process is to order the distances between the cross-dock warehouse and individual shopping centers from the shortest to the longest distance (*see Table 2*).

Tab. 2 *Order of the distances between the cross-dock warehouse and individual shopping centers*

S_i original	S_1	S_2	S_3	S_4	S_5	S_6	S_7	S_8	S_9	S_{10}	S_{11}	S_{12}	S_{13}	S_{14}	S_{15}	S_{16}
S_i new	S_5	S_{12}	S_2	S_1	S_{11}	S_7	S_9	S_3	S_{15}	S_6	S_{14}	S_{13}	S_4	S_{10}	S_{16}	S_8
d_i [km]	1,0	1,0	1,1	1,2	1,6	1,8	2,2	2,3	2,9	3,2	3,3	3,4	3,6	4,7	5,3	5,9

Source: Authors

The total waiting time may be expressed by the objective function:

$$\sum_{i=1}^{n} t_i = (2n-1).d_1 + (2n-3).d_2 + \ldots + 3d_{n-1} + d_n \qquad (3)$$

Since *n* is fixed to minimize the total waiting time it is necessary to select for d_1 the shortest distance, for d_2 the second shortest distance, etc, and for d_n the longest distance, this means to use the supply sequence from *Table 2*.

Individual distances, which one vehicle travels when supplying the shopping centers from one starting cross-dock warehouse, are determined using the selected algorithm.

The *Table 3* contains the results of above mentioned procedure, where the distances are shown and ordered. These distances concerning the supply of the shopping centers by one vehicle when operating from the cross-dock warehouse to the customers with the resulting data on total traveled distance t_i of one vehicle to new shopping center S_i.

Tab. 3 *Resulting order of distances with the results of traveled distances (t_i) by one vehicle when operating*

S_i orig.	S_1	S_2	S_3	S_4	S_5	S_6	S_7	S_8	S_9	S_{10}	S_{11}	S_{12}	S_{13}	S_{14}	S_{15}	S_{16}
S_i new	S_5	S_{12}	S_2	S_1	S_{11}	S_7	S_9	S_3	S_{15}	S_6	S_{14}	S_{13}	S_4	S_{10}	S_{16}	S_8
d_i [km]	1,0	1,0	1,1	1,2	1,6	1,8	2,2	2,3	2,9	3,2	3,3	3,4	3,6	4,7	5,3	5,9
t_i [km]	1,0	3,0	5,1	7,4	10,2	13,6	17,6	22,1	27,3	33,4	39,9	46,6	53,6	61,9	71,9	83,1

Source: Authors

In this particular case, the optimal supply sequence is 5, 12, 2, 1, 11, 7, 9, 3, 15, 6, 14, 13, 4, 10, 16 and 8.

Determination of the total driving performance and also the total waiting time of the customer (given in km) when using one supply vehicle for operating the shopping centers is the final output of above realized calculations. This driving performance is $\sum_{i=1}^{n} t_i$ = 497,7 km.

4 Conclusion

The paper is focused on the simple algorithm which helps to solve the traffic problems, as well.

Generally, the algorithms for typical optimization problems go through a sequence of steps with simple choices of steps until complete solution. This particular algorithm, also known as “Greedy” algorithm, consists of small parts of work. Determination of the total customer waiting time for goods, which refers to the transport distances, is the final output of this algorithm. These distances do not contain time required for loading and unloading.

Acknowledgement

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References

[1] PEŠKO, Š. and M. PONČÁK, 2006. *Lagrangian heuristic for fastidious travelling salesman problem, Mathematical, econometrical and computational methods in finance and insurance*. Katowice: University of Economics. pp. 223-229. ISBN 83-7246-811-7.

[2] YUJUN, Z., CHUANQING, X., JINYUN, X. A., 2009. *Simple greedy algorithm for a class of shuttle transportation problems*. Optimization letters. September 2009. Volume 3, Issue 4, pp 491-497, ISSN 1862-4480, Available from: <http://link.springer.com/article/10.1007%2Fs11590-009-0126-9#page-1>.

[3] LAMBERT, D., STOCK, J., ELLRAM, L., 2000. *Logistika*. Praha: Computer Press. 589 pages. ISBN: 80-7226-221-1.

[4] KUBASAKOVA, I., KAMPF, R., STOPKA, O., 2014. *Logistics information and communication technology*. In: Communications: scientific letters of the University of Žilina. Vol. 16, no. 2 (2014), pp. 14-19. ISSN 1335-4205. Available from: <http://www.uniza.sk/komunikacie/archiv/2014/2/2_2014en.pdf>.

[5] STOPKA, O., KAMPF, R., KOLÁŘ, J., KUBASÁKOVÁ, I., SAVAGE, CH. *Draft guidelines for the allocation of public logistics centres of international importance.* In: Communications: scientific letters of the University of Žilina. Vol. 16, no. 2 (2014), pp. 9-13. ISSN 1335-4205. Available from: <http://www.uniza.sk/komunikacie/archiv/2014/2/2_2014en.pdf>.

Resume

The paper presents a specific class of traffic problems when the supplier, the supply warehouse in this case, expedites the goods to the group of customers. The paper presents a simple but powerful "greedy" algorithm, classed among heuristic methods, that provides good results close to the optimal solution.

Key words

"Greedy" algorithm, supply, operation, shopping center, cross-dock warehouse

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THE CUSTOMER SERVICE OF LEASING COMPANY AND ITS ANALYSIS

Eva KICOVÁ, Ladislav JARINA

Introduction

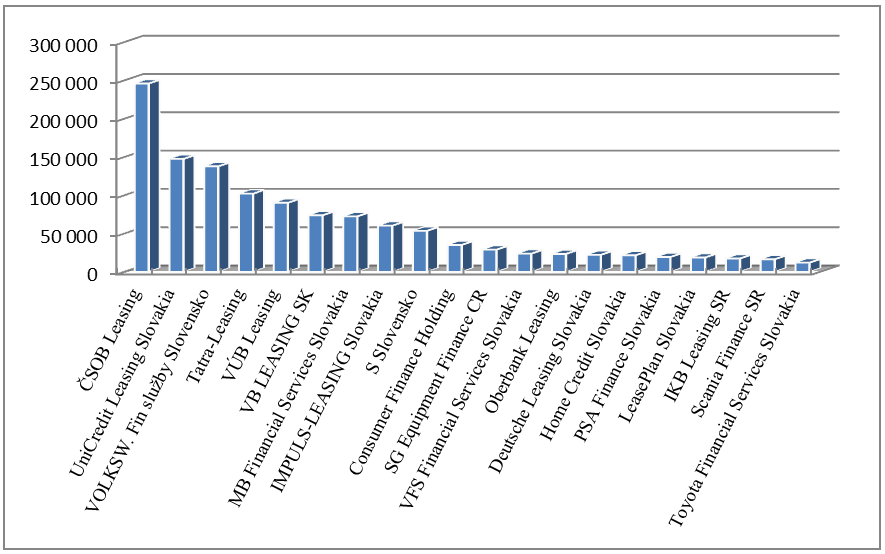
The Leasing market as a part of financial market in Slovakia, belonged to sectors which go through the most dynamic process of inner changes as an economic crisis consequence, which fully became evident by strong drop in amount of realized businesses in years 2008 – 2009. The recession strongly checked the stability of particular companies, primarily the stability and quality portfolio of concluded leasing contracts, the client base and the power of business partners. The leasing market noticed 45 percent slump in this period. Currently the leasing companies have relatively stable market distribution within Slovakia. Particularly within first ten chart of leasing companies in Slovak market the situation in market is stable from the view of leasing company stability. The leasing companies participate mostly in car financing, new and used busses, freight and special motor vehicles, new and used building and producing machines, lines and business properties.

First three places in leasing company chart belong to those companies which provide net brand financing for particular car brands (for example BMW finance, Renault finance, Honda finance, Kia finance are covered by UniCredit Leasing, a.s.). These positions are virtually „dauntless“ by other general leasing companies without net financing.

1 Financing on general leasing market

We can state that the leasing market happens to slowing down of economic increasing and competition of leasing companies in this field requires close concentration on customers satisfaction, improving attitude and strengthening the field of customer service.

Fig. 1 *The order to the biggest leasing companies in SVK according to type of item for 1. - 3. quarter 2013 (in acquisition prices not including VAT in €)*



Source: [7]

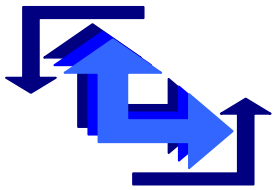
1.1 The customer service in service enterprise

„The customer service in service enterprise exists before, during and after acquisition other and superordinate service as well which represents own reason for shopping decision. So the customer service has character of supplement (secondary) service. When purchasing merchandise or service we meet „the true moment“ in form of sell-out added service, which customer at first expect the company offer, as a proof to customer, that he had chosen the best among competitive offers on the other side [2].

Service companies are currently aware of that building long-term, mutually suitable and stable relationship with customers represents the way to company prosperity, maintaining the customer and following repetitive product sale or service to existing customer.

The biggest number of customers keeps those companies which prove in each true moment that they had chosen the best among competitive offers. The quality and value of service provided is the center of attention. The customer service helps to complete comprehensive service character which the company provides. The service tasks are [2]:

- Differentiation of company offer,
- creating, management and innovation of additional service, which should support selling service of basic portfolio,
- to do primarily products more attractive comparing to competitors,
- to gain competitive advantage.



The practice proves that companies that paid enough attention to customer service noticed improvement of market position and increased their share market. Most of additional service is by competitors easily copied and only permanent research, analysis and following modernization its offer of additional service, the company provides differentiation of its offer against the competition. In general we can divide the customer service to [2]:

- technical service,
- commercial service,
- representation service.

In companies providing service mostly dominate service of commercial and representation character. Trade service in financing service field includes mostly information and consulting service, websites and possibility of self-service through the internet. The representation character service include refreshment during providing or waiting for service, the possibility of using the reserved parking space, company`s copy machine, Access to internet-WIFI free zones, priority execution. Escalating competitive surroundings in financing service field in Slovakia leads to bigger and bigger placing demands on customer service. Everyone can offer discount but good service only the best provider.

1.2 The service quality

The quality of each service is in general tested in every providing and during whole process. The expectations of customers which they create from many sources, as example last experience, experience and recommending of acquaintances, ads, not always correspond with perceiving service. If the perceiving service doesn´t reach the expecting level, the customer might be disappointed. Successful companies need to make special their products by additional advantages, which customers not only satisfy but delight and surprise.

The team of experts (Parasuraman, Zeithaml a Berry) formulated the model of service quality, which highlights basic conditions for providing high service quality. The Model identity's five differences characterizing unsuccessful service providing [4]:

1. The difference between management perceiving and specification of service. The management can correctly perceive customer wishes but doesn´t determinate performance standard.
2. The difference between specification of service quality and its providing.
3. The difference between service providing and external communication.
4. The difference between perceiving and expecting service.

In conformity of service quality model, they identified five determinants of service quality, which they present in following order according to importance [5]:

- **reliability** – the ability to carry out the promised service reliably and perfectly,
- **willingness** – the ability to help customers and their immediate obliging,
- **assurance** – knowledge and courtesy of employees and their ability to bring out the trust,
- **empathy** – providing of caring, individual attention to customer,
- **material elements** – design of physical buildings, , employees and communication equipment's.

On the basis they created the scale SERVQUAL – service – quality with 21 items, which are supposed to help the determination to companies the tolerance zone of customer.

Fig. 2 *The scale attributes SERVQUAL (service-quality)*

Reliability
- Service providing as promised - Reliability at dealing with customer problems and service - Correct service providing immediately at first - Service providing in promised time - Keeping faultless records
Ability to react to customer requests
- To provide information to customer about time service providing - Speed of service - Willingness to help customers - Preparedness to react to customer requirements
Assurance
- Employees, who cause trust in customer - To assure the sense of safety to customer at their transactions - Employees, who are always courteous - Employees, who are able to answer customers questions
Empathy
- To provide individual attention to customer - Employees, who treat carefully with customers - Employees, who do the best in favors of customer - Employees, who understand the customers needs - Advantageous opening hours for customers
Material issues
- modern equipment - visual attractive environment - clean and professional dressed and nice employees - visual attractive material connected to service

Source: [4]

In strong competitive pressure of leasing market in Slovakia is controlling and increasing the quality of own products and total service one of the strategic tasks of marketing section. The quality of provided service as a final product strongly influences satisfaction and customer loyalty, it is necessary condition for repetitive sale. For increasing

quality we can strongly contribute proper setting and interaction of particular components of marketing service mix.

2 Analysis of service provided in leasing companies

Proper setting and adapted customer service can be strong competitive advantage for company providing service. Proper providing of secondary service solution leads to repetitive sale and using the potential of existing portfolio leasing company customers. The target is the portfolio stabilization. To specify and separate services, which we can individually name as customer service is very complicated. Most of leasing companies within SVK currently don´t have specific section, which would be dealing only with requirements and customer care.

Within analysis of leasing companies service is possible to focus on:

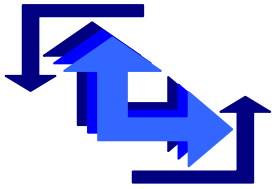
1. Searching for new customers and offer procedure:

This field has the biggest influence on amount of new enclosed business. Here belong for example:

- Creation and portfolio customer report
- Segmentation and customer profile
- Activation operation
- The meeting arrangement
- The system of regular visits
- Introduction of new products
- Portfolio innovation

2. The customer care:

- Authorization making out
- Assembly and component report of leasing service
- Report and certificate report about vehicles register
- Proper finishing of leasing contract
- Procedure changing and transfer of leasing contract
- Cancellation of leasing contract
- Extraordinary finishing of leasing contract
- Information line for consultancy
- Technical support
- Loyalty program for customers



- Survey of customer satisfaction

3. Claim management

Providing finance service is from the view of customer very important way of solving and claim managing. Regarding to service character, it is very sensitive sphere which is very often the source of negative experience of client with company. In case of claim management, there is need to pay attention to early reaction and appropriate repeating of offender warning. Not every client offender is done on purpose (unmatched remittance as consequence of incorrectly stated variable payment symbol, non-payment fruition resulting the payment order due to current want of money on account,..) and early remark not paid instalment through SMS message can prevent bigger problem, or needless client penalization.

Systematic reminding of not paid instalment and looking into current client payment situation prevent the following noticeable problem in form of client payment disability potential short-term payment disability of second degree which in early discovery can be solved by postponement of leasing the instalment or by restructuralization of payment schedule. These precautions can help client to overcome the period of financial lack for covering debt service. The main positive resulting from service for the client is not only from the view of help with cash flow recovery, but on first place the problem solution and communication with claim management department is client able to avoid recording about payment disability in credit and nonbank registers operating in Slovakia. Records about offender client subsequently noticeably complicate or forbid possibility to gain financial support in form of loan or leasing in the future – they have big influence on financial rating and client profile.

Within the claim management is necessary to analyses for example:

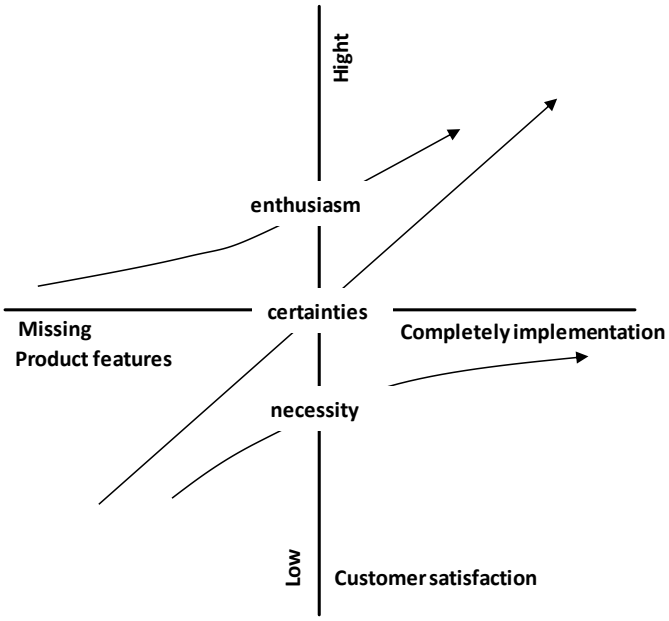
- The evaluation of delayed payments and risk,
- Claim report within 60 days – Soft Collections (CS),
- Claim report over 60 days – Hard Collections (HS),
- Determination of delayed cause,
- Operations CS: outgoing call, automatic SMS, payment promise, automatic letter (client + surety),
- Operations HS: personal visit, leasing object check, collection agencies, object leasing revocation,
- Restructuralization of leasing contracts,
- Solution of complicated contracts.

2.1 The survey of customer satisfaction

The quality in general represents the summary of service character, which were set in advance knowingly and unknowingly from the client side. The satisfaction is subjective feeling of customer following from ones perceiving of fulfilled measure personal requirements and expectations and needs within acceptable conditions and possibilities.

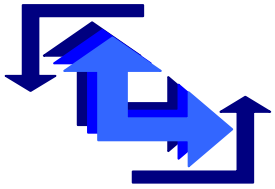
More and more companies understand that the survey of customer satisfaction is the key to permanent success. Mostly goes about ability to understand and foreknow their future needs with target to reach positive reaction on provided service. The model of professor Noriami Kano, who for the first time published in 1984 and says about asymmetric and non-linear dependence between customer satisfaction and parameters of service functionality (service parameter: necessity – prescribed, commonplace – expected, extras- surprising):

Fig. 3 *The model of customer satisfaction*



The base condition of customer satisfaction is the quality service but satisfaction is subjective and can change in time therefore it is need to watch it. The satisfaction survey is for the company effective analytic tool with big notice value. It enables the company to use its results for: one-shot determination of satisfaction measurement, watching effectiveness of approved precautions or realized campaigns and can in time show unfavorable development.

Many leasing companies currently don´t provide satisfaction survey of their customers by any methods with what they the possibility to accept precautions for improvement quality of providing service with target to increase the measure of customer satisfaction.



The quality improvements provide service, however by Križanová it helps to build up long-term relationships with customers based on mutual trust. On the other way missing direct feedback about customer satisfaction with service which weren´t provided, delayed reactions on consumer negative perceiving precautions, delayed reactions on unfavorable development or missing information about insufficient expertise and staff professionalism can be danger and lead to loss of competitive advantage.

It is necessary to realize that the client needs the leasing company as legal, physical or private person in time of realization of investment plans, what is most of the time only once per several years. Therefore it is necessary within leasing company pay attention to substantial part of work to searching for new business opportunities and to take care of new customers i.e. acquiring. However it is not possible to forget about the existing clients. According to surveys 60 % of customers stop communication because they only feel indifference and unconcerness from company`s side. High standard and adequate providing of customer service is base for support of repetitive sale in each company. Using and support business opportunity within existing customer base increase value of customer for company. Active attitude influences increasing receipts, strengthen position in market and at least company cost reduction.

Direct way for standardization and quality improvement of customer service and support of repetitive sale is to build up individual contact center providing customer service in meaning of principals CRM. The contact center – Customer service section is the way not the target. The very important condition for support of correct customer section functioning is functional information system, the part of it is current customers database (necessary condition is also provision of technological support and equipment).

The implementation of CRM system according to Nadányiova solves information gathering and up-dating the customer profile. Up-dating of customer base, its keeping, searching, selecting and analysis provide valuable information and statistics for management and it helps to:

- Preparation of specialized and aimed offers for individual target segment of customer,
- Success-rate evaluation of business strategies and activities on the basis of possibility immediate success-rate evaluation,
- Plan opportunities and realization direct marketing activities and checking their success-rate,
- Watching possibilities and evaluation of activities and the results of individual employees

For correct process setting within offered customer service section is important segmentation to company customers for example due to reached receipts. Concept

implementation CRM – management of relationship with customers as target to reach long-term and valuable relationship requires unification of company processes into unified marketing conception. Everything is connected to everything. The basics of building connections are good human resources, technological support, customer database and dynamic organization structure adapted to providing complex service. Reaching wished results implementation of conception CRM requires providing high quality service. Among substantial conditions of reaching the highest quality belong service standardization and checking processes. Customer service section made within conception CRM requires accurate specification of service range and belonging solutions, service provision. Very important is also customer satisfaction survey, which can have various forms.

3 Conclusion

In current growing stronger competitive surrounding of leasing market is very difficult to be different. The company which wants to be successful in competitive contest, cannot build up only on quality and product extraordinariness, these characters are quickly imitable. For long-term success with strong base is the most substantial philosophy customer change on customer oriented company. This can make new possibilities for leasing companies. By improving provided customer service are made for these companies new possibilities to keep old customers, but also gain new ones. It is very important to pay attention to enterprises providing bus transport, because the need of increasing quality of transport service will require renewal of these haulers vehicle park.

References

[1] BIRNEROVÁ, E. - KRIŽNOVÁ, A. Základy marketingu II. 2. vyd., Žilina : ŽU – EDIS, 2008. 146 s. ISBN 978-80-8070-906-8.

[2] BIRNEROVÁ, E., Marketing služieb, EDIS – vydavateľstvo ŽU, 2009, 140s. ISBN 978-80-554-0064-8.

[3] JAKUBÍKOVÁ, D.: Strategický marketing: Strategie a trendy, Praha: Grada Publishing, a.s., 2008, 269 s. ISBN 978-80-247-2690-8.

[4] KOTLER, P.: Marketing podle Kotlera: Jak vytvářet a ovládnout nové trhy, Praha: Management Press, 2000, s. 258 ISBN 80-7261-010-4.

[5] MISTRÍKOVÁ, M.: Služby zákazníkovi ako podpora opakovaného predaja v leasingovej spoločnosti, diplomová práca, evidenčné číslo 28330120122105.

[6] NADANYIOVÁ, M.: Marketingová komunikácia podniku prostredníctvom internetu, In: Globalizácia a jej sociálno-ekonomické dôsledky '10 [elektronický zdroj] : zborník príspevkov z medzinárodnej vedeckej konferencie : Rajecké Teplice 4.-6. október 2010. - ISSN 1336-5878. - [Žilina: Žilinská univerzita, 2010]. - S. 367-374. - Požiadavky na systém: CD ROM mechanika.

[7] Asociácia leasingových spoločností Slovenskej republiky.

[8] http://www.euroekonom.sk/marketing/novodoby-a-moderny-marketing/crm-riadenie-vztahu-so-zakaznikom/.

[9] http://www.ibispartner.sk/sk/zakaznicky-fokus-a-predaj/420-zakaznicky-servis-je-cesta-nie-ciel-15-sposobov-ako-zacat.

[10] http://referaty.hladas.sk/referat.php/teoria-sluzieb/21/18462.

[11] http://referaty.atlas.sk/odborne-humanitne/ekonomia/13924/?print=1.

[12] http://www.cognizant.com/InsightsWhitepapers/Performance-Management.pdf.

[13] http://www.tfl.gov.uk/microsites/graduates/171.aspx.

[14] http://www.armstronglc.com/caseStudy/60062-logistics-performance-management.

Resume

The aim of this paper is to point to service analysis which is provided to customers by the leasing companies. The leasing companies are a part of financial market and on the other side they represent the possibility of the vehicle park renewal for bus carriers, with what they contribute to increase the quality of the services they provide. Within the bounds of paper we point out the necessity of providing customer satisfaction survey in leasing companies.

Key words

The customer service, the quality, the satisfaction survey, the leasing company, CRM system

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IMPLEMENTATION OF ELECTRONIC DATA INTERCHANGE (EDI) AS A MODERN METHOD OF COMMUNICATION BETWEEN BUSINESS PARTNERS

Vladimír KLAPITA, Eva MAJERČÁKOVÁ

1 Introduction

At the present quick time, the information is considered the most valuable commodity at the market. As the most important characteristics of information is considered its quality and timeliness, i.e. speed of delivery designated entities. In the business transactions between the two business entities, the speed of data transmission, including data, relating to order or payment, may have the value of millions EUR.

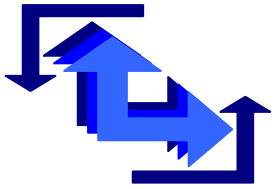
The introduction of computer technology into business processes helps to accelerate the transmission of information and the associated faster creation and processing documents.

Employees working with business documents have required information much faster than employees who use sending information in a physical form.

2 Electronic Data Interchange - a modern way of communication

For this purpose there was developed a standard EDI (Electronic Data Interchange). EDI is a modern way of communication between two independent entities, in which standard structured business documents are exchanged with other documents, such as orders, delivery notes or invoices, electronically. EDI is most often used by commercial organizations in the field of trade, industry and services (financial institutions, tourism, transport, logistics), but also the organization of state administration and public administration.

The main objective of these systems is a gradual replacement of paper documents by electronic documents. The reason is to reduce the costs associated with the exchange and simultaneously increase the speed and efficiency of transmission, but also the possibility of further automatic processing. The biggest benefits bring the introduction of electronic communication within regular exchange of large amounts of standardized documents. EDI documents have the same legal weight as documents "paper". Using EDI may occur linking various information processes inside and outside the company. Data exchange is by automating the whole process much faster and also cheaper. EDI communication is defined



and guided by supranational standards. It is a time-tested technology that can be used with business partners from all over the world. In these modern times there are EDI solutions that are accessible to practically anyone and it can be used in any industry. Depending on the individual branches certain standards are used in electronic communication, such as EDIFACT, ODETTE, VDA or standards based on XML and more. For electronic communication it is necessary, that both partners are able to communicate within certain standards. This capability ensures their compatibility with business partners.

A practical example with the order shows the work of EDI the best. This is a comparison of the order inside the company without the use of EDI and conversely with its use (see Table 1).

Tab. 1 *Individual steps of movement goods order without and with using EDI*

Number of steps	***Order of goods in the traditional way - without the use of EDI***	***Order** of goods **with the use of EDI***
1.	**Purchaser** confirms the order in its information system (for example SAP)	**Purchaser** creates order in its information system (for example SAP). Created order goes through EDI electronically to the supplier.
2.	**Purchaser** will print order from the system and send it by fax or e-mail	**Supplier** receives EDI order into its system. Order arrives electronically and acceptance seems that the order automatically "created" in the information system.
3.	**Supplier** accepts order by fax or email, will print it	Further is processed the order, ongoing removal, delivery of goods, invoicing etc. Exchange of all other documents (delivery note, invoice) can also take place via EDI.
4.	**Supplier** overwrites the order from paper forms into its information system	
5.	Further the order is processed, ongoing removal, delivery of goods, invoicing etc.	

Source: prepared according to [6]

Compatibility in this communication is ensured by using international standard, which is marked UN / EDIFACT. To implement this standard in the organization means

advantages in terms of maintaining and increasing competitive advantage at domestic and foreign markets. Organizations with a large number of purchasers or suppliers use electronic data interchange and require its use also from its trading partners. Compliance with the standard ensures global organization GS1, active in Slovak and Czech Republic [4].

For better transparency it is possible to show the process of moving goods orders without and with using EDI in the following figures (see Figure 1 and Figure 2).

Fig. 1 *Typical manual process without using EDI (lots of people and paper)*

Source: [7]

Fig. 2 *The process with using EDI (no people, no paper)*

Source: [8]

The main advantages of EDI, arising from the example, include:

- Increase of employees´ productivity.
- Reduction of the costs of postage, printing and recording.
- Reduction of the administration costs.
- Clearer information about making a payment.
- Acceleration of document flow.
- Simplification of transmission of documents and their archiving.
- Limiting errors in manual entry of data.
- Increase of security for transferring documents.
- Improvement of the relationship between business partners.

- Smaller number of irregularities in the business transactions.
- Unified communication of different systems and operators.
- More effective planning and management of production, trade.
- Easier supplying and strategic planning of supply. [2]

Based on these advantages, the priority benefits of EDI communication include:

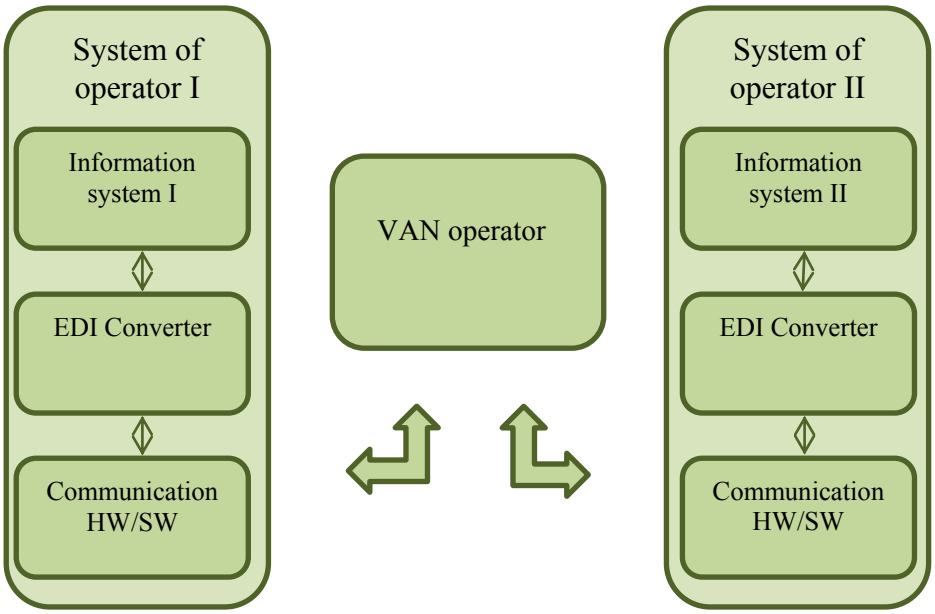
- It is faster, saves time - reduces delays in the transmission of documents, eliminating the rewriting messages from the system to the system.
- It is more reliable, increases the quality - improves services to customers and can respond quickly to their needs, are eliminated clerical error in the documents (typos, unreadable fax).
- It is cheaper, saves money - saves labor force and costs (eliminates certain types of documents (by mutual agreement), reduces fees for phone, fax paper, postage, etc.).

3 Transmission of EDI messages

The connection of the participants transmission of EDI messages are mostly done through private dedicated networks with increased security, i.e. through the network type VAN (Value Added Network). Those networks transmit data means "store and retrieve". Each user has a mailbox and network operator type VAN performs transactions between mailboxes for each user. The role of VAN operator is to ensure the distribution of standard reports and items. Network type VAN acts as a middleman - the software supplier, it means the converter and communication software for connecting to the VAN network. Converter and communication software are on the client side. While the client also bears the costs associated with their establishment and management (see Figure 3).

A substantial disadvantage of this connection is the fact that the sender is not informed about when the recipient selects the message from the mailbox. This means that the message can "lie" in the box unnoticed for days and hours. Another disadvantage is the high cost for use of the service VAN and therefore it is not suitable for smaller organizations. It is more suitable for large organizations with large capacity of communication.

Fig. 3 *Scheme of transmission EDI messages via the network type VAN*



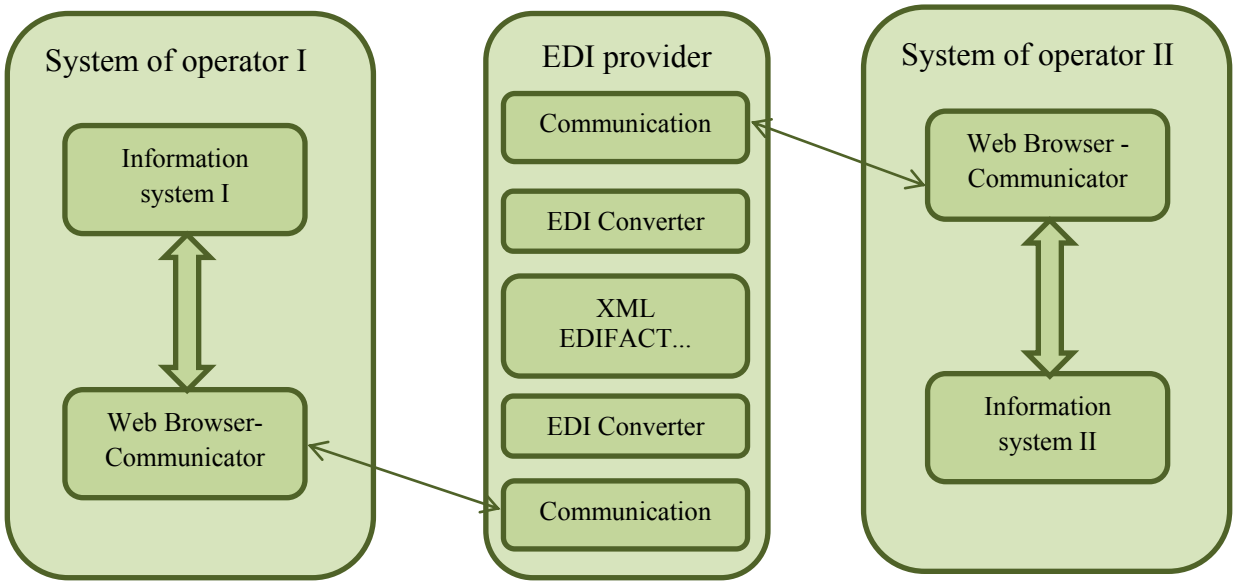
Source: prepared by [2]

Connection using network-type X400 works on the principle "store and forward". Advantage of the connection is the fact that messages convey to the recipient soon as it adopts and the messages does not reside in boxes. Sometimes this can be a slow connection. [5]

Currently there are such types of EDI solutions at the market that are beneficial to large companies, but they are also available to small and medium-sized companies. Principle consists in that the advanced EDI solutions eliminated the most common barrier to the introduction of EDI and this is the complexity of the system and the unfavorable ratio of price and performance.

The scheme of EDI solutions originates from the model of communication via VAN operator using EDI provider. For the main platform for communication is considered to use of the Internet. The clients do not need specialized converter or specialized software to communicate on their side. Everything is secured by EDI provider. Its role is operation more clients and communication with other EDI providers and their clients. EDI provider accepts data from the information system of one subject (via the Internet) and then are these data changed by converters to its internal standardized format (XML, UN / EDIFACT). Data are changed again before sending (through the EDI converter) on the format of the recipient and sent via the Internet to the information system of the other subject (see Figure 4).

Fig. 4 Scheme of transmission EDI messages by using EDI provider



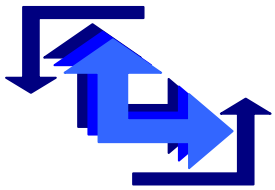
Source: prepared by [2]

The advantage of the EDI solution is its availability via commonly used Internet network. Another advantage is that the provider takes all activities for the user associated with the conversion and delivery of data. This leads to the elimination of costs associated with the management of EDI system on the client side. [2]

4 Application and implementation of EDI

The idea of EDI application is simple, its implementation is a little more complicated. It can cause significant problems for the organization, because fundamental questions are raised about the meaning of existence each of its activities and the meaning of its existence. Benefit from the implementation and use of EDI can be achieved only if all activities give each other a sense of each activity and its importance are reviewed separately. [5]

The introduction of EDI communication requires close coordination between the supplier reports, the recipient and the provider of EDI messaging server. The establishment consists of several major steps, which differ from each other depending on the circumstances of implementation (use of information systems, the choice of EDI solutions, way of working in the company, etc.).



The main points:

- Selection of EDI solutions and provider,
- Securing the communication,
- Ensuring the identification,
- Ensuring the integration [6].

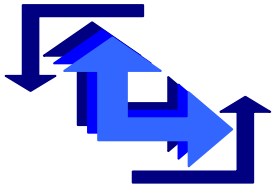
Implementation is divided into the following steps (steps describe the implementation of EDI solutions ORION):

- **Identifying** the EDI, getting ideas about what can bring EDI to the company, what can expect from it and what is required.
- Leads to the **selection of a suitable EDI solutions** and provider (based on lessons learned).
- **Designing best practices, steps and deadlines,** that recommends and takes EDI provider with the competent staff of the company.
- For ensuring the integration is essential **the preparation of the interface** for communication with EDI System.
- **For ensuring the communication** with EDI mailbox (EDI provider), you must have an Internet connection or to be connected to an Internet provider.
- **Ensuring the identification number**, this number is assigned by company GS1. Producers who indicate their goods EAN codes, already have this number.
- **Testing of EDI Interface** - the necessity to test correctness and completeness of content.
- The actual **implementation** of EDI solutions - starting the testing operation with purchasers / suppliers.
- **Verification operation** of exchanges EDI messages [6].

The whole process of implementation EDI takes about 30-90 days, depending on the capabilities of the computer system used. In the case of the standard implementation of a system that already has EDI module, it is possible to reduce the time of implementation EDI on 5-10 days.

5 Conclusion

EDI is a modern way of communication between two independent entities, in which standard structured business documents and other documents, such as orders, delivery notes or invoices are exchanged electronically. The main idea of EDI describes an example of the order, which is illustratively described in this paper (see Table 1). It follows that the



objective of EDI is a gradual replacing paper documents by electronic and reducing costs associated with the exchange.

The fact that EDI has a lot of advantages and benefits that lead to streamlining and improving the process in the company plays a very important role in the implementation of EDI technology. This fact is an impulse for small and medium-sized enterprises and large organizations to introduce this technology. In fact, there can be another reason for the implementation of EDI into business, which is to endeavor to meet important purchasers - retail chains. For many suppliers, this is the real reason why they think about EDI. Nowadays many chains are asking for using EDI as one of the main conditions of trade cooperation. In this case, the actual access to EDI - how new technology can be perceived by the business negatively, because the company does not own convictions about how beneficial the implementation of EDI can be.

However, if the company correctly perceives the introduction of EDI as a way to streamline and improve business processes, so together with appropriate EDI solution brings benefits to the purchaser and supplier.

References

[1] HRENÁK, D.: *Použitie EDI a XMLv medzipodnikovej komunikácii*, [online]. Bakalárska práca, 2008. Dostupné na http://is.muni.cz/.

[2] REICHEL, D.: *Ako na elektronickú výmenu dát?,* [online]. CCV Informačné systémy, 2009. Dostupné na: www.ccvis.sk.

[3] TOMÁŠEK, J.: *Vývoj standardů EDI* – projekt ebXML, [online]. zbornik Systemova integrace, 2004. Dostupné na http://si.vse.cz/archiv/.

[4] KAMPF, R., PRŮŠA, P., SAVAGE, C. Systematic location of the public logistic centres in Czech Republic. (2011) Transport 26 (4) PP. 425 – 432, ISSN: 16484142S.

[5] http://www.efocus.sk.

[6] http://www.edizone.cz.

[7] http://www.teledin.cz.

[8] http://www.edibasics.co.uk/what-is-edi/.

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CLASIFYING AND ANALYZING PROJECT RESOURCES IN PROJECT PORTFOLIO OPTIMIZING PROCESS

Pavol KRÁĽ - Peter MAJERČÁK

Introduction

Practice nowadays commonly encounters a situation in which an organization is carrying out several projects at the same time, while consuming available resources together. Therefore care needs to be taken to plan and manage projects not only as individual entities but also ensure their comprehensive management using advanced project management methods and suitable approaches and techniques for managing and coordinating whole project portfolio.

Implementation of projects is generally set out in parallel which requires coordination of all the aspects entering the process, in particular as regards resource coordination, their efficient use and allocation among projects and other activities of organization. Projects shall differ from each other in their nature, scope, type of output, demands on implementation, resource need, time framework etc. This shows that we hardly find a project portfolio that is homogenous in all aspects.

Efficient project portfolio management assumes such a project portfolio that involves projects being carried on in a given time and that consumes limited resources of an organization reasonably for such projects that shall provide the organization with the expected development defined in the strategic aims and in line with the generic strategy.

1. Project resources - definition

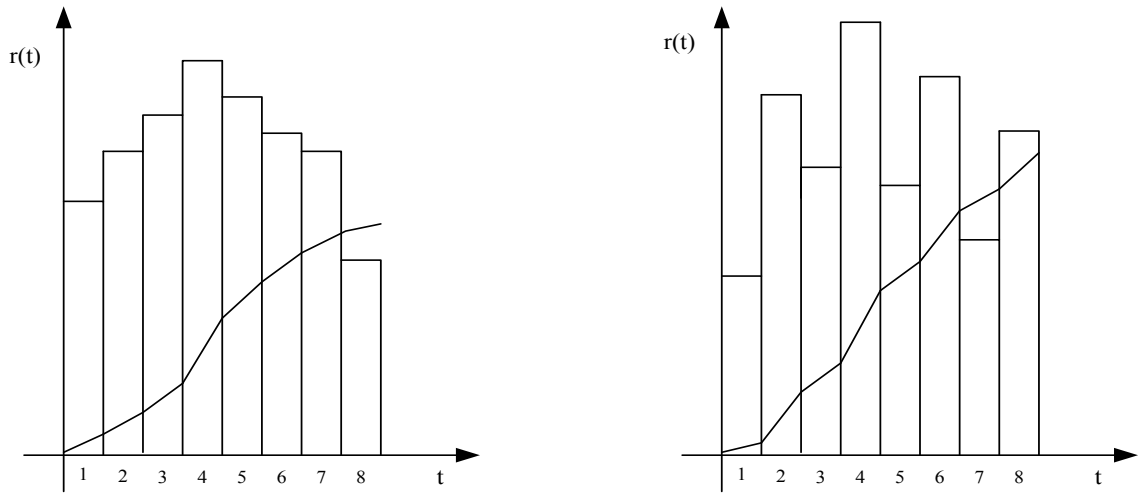
Consumption of diverse resources occurs during the project implementation. The consumption in time is generally uneven and availability is limited. These facts determine the way we manage project resources.

We understand the term 'project resource' as any quantifying factor or a means required for carrying out a project activity and which is being consumed during the time of its implementation (work of people involved in project, machines, equipment, information,

services, funds etc.). The most valuable and the most questionable project resource are people. We do not recognize the time framework of a project as a resource.*

Requirements on project resources are not constant during the implementation of the project in terms of structure and volume. The resource consumption depends on logical scheduling of project activities. The more even are the requirements within the monitoring periods in terms of volume, the more efficient usage and management we ensure (Fig. 1).

***Fig. 1** Resource requirements*



a) more even resource requirement *b) less even resource requirement*

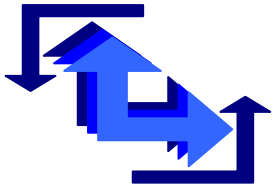
Source: own processing

Project management or project portfolio management with uneven resource distribution requirement is significantly complicating. This may pose an enormous resource strain and on the other hand result in downtimes and an inefficient use of resources.

In order to plan and analyze project resources we have to identify all types of resources required, set up the real consumption in time and optimize their use so to avoid occurring a condition in which the actual resource availability does not cover the real need at some point in time of the project implementation. Thus, we have to consider the following:

1. ***Timing*** - a strive for implementation of a project within due date or the date that exceeds the due date the least

* The relevant literature may also list the term 'means', which refers to a project resource. Hence the term 'resource' shall be understood as a place the means come from.



2. ***Costs*** - an efficient use of funds in acquisition and consumption of resources; not exceeding the budget

2. Project resource classification

We shall classify project resources according to several characteristics:

1. *Resources from the matter point of view:*

- financial resources
- human resources
- technical and technological resources
- other resources

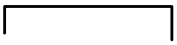
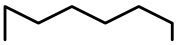
2. *Resources from the point of view of storage:*

- storable
- non-storable

3. *Resources from the point of view of their consumption nature in time regarding project activity:*

- Regular consumption resources - we use such resources over the activity lifetime t_{ij};
- Concentrated consumption resources - we use such resources in a very short time period in proportion to the total value t_{ij};
- Occasional consumption resources - resources that show in turn combination of use at value *r(ij)* and zero use in time t_{ij};
- Combined consumption resources - includes resources that combine the above-mentioned types.

Fig.2 *Resources considering the consumption nature in time*

Consumption nature	Constant consumption	Lowering consumption	Rising consumption	Pulsing consumption
Regular consumption				
Concentrated consumption				
Occasional consumption				

Source: own processing

4. *Resources from the point of view of type of restriction*[1]*:*

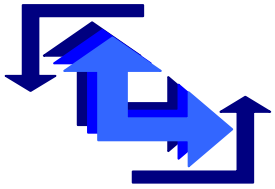
- Renewable - resources of a restricted use in each point in time of the project implementation (people, machines, equipment etc.). Their use is connected with timing;
- Non-renewable - the total use here is limited over the project lifetime (funds, material). The use of them is connected with costs;
- Double-restricted - resources adopting the constraints of both previous types (energy).

5. *Resources concerning links to project activities:*

- Separable - resources that are to be divided between individual project activities and project activities being carried on in parallel;
- Non-separable - it is possible to use such resources only with one project activity.

6. *Resources concerning links to project portfolio:*

- Cumulative resources ZG - here we speak of a single resource available for all the projects defined in an input plan. It is determined by a single attribute - one numerical value - a (budget) capacity planned for implementation of all the projects provided that the cumulative resource requirement of this kind does not exceed its disposable capacity. We shall define the cumulative resource constraint by: $Z_G = \{capacity\}$.
- Segmental resources ZS represents the sequence of resources with a defined order and varying capacity. Each of the projects under consideration must have a defined segment (a time period) in which it might be carried out. The optimum project portfolio then informs in which segment the project or its activities are to be carried



out.* Resource cumulative requirement must not exceed its capacity within the segment provided that a different capacity of available resources might be determined in each time period. The attributes of segmental resource shall be defined by: $Z_S = [\{capacity\}, \{capacity\}, ..., \{capacity\}]$.

3. Project resource analysis

Resource planning assumes identification of all the resources essential for project implementation and the knowledge of their real availability (resource constraints specification). We may commonly encounter a situation in which a real resource availability R does not allow carrying on activities in parallel due to failure to cover the real resource need even the coherence of activities allows the implementation of them simultaneously. It is only resource-to-activities allocation that will reveal this clash; however we did not consider that in the timetable. The real resource availability R may vary at the time the activities are carried on. The availability is determined either by external environment, which is in fact uncontrollable by organization, and also by internal factors with a direct form of controlling. Consequently, the ambient factors determine the resource availability the room for increasing their capacity is limited.

The methods for analyzing project resources shall remove such discrepancy and ensure continual implementation of a project as soon as possible. Here we stem from the assumption that every project activity requires r_{ij} resources in each time period.

When analyzing project resources we usually deal with the following tasks:

1. *Resource cumulation in project time periods* - the sum of the resource requirements *r(t)*, individually with each type and for each time period (resource need sum line);
2. *Resource leveling* - the most even resource use over the project implementation lifetime provided that we do not exceed given termination date;
3. *Resource allocation* - to detect the shortest time for project implementation on the basis of the real resource capacity (disposability) R in each time period t assumption:

$$r(t) \le R \qquad (1)$$

It is necessary to stress out that in this case we expect to analyze resources separately with each resource.

* We assume one activity being carried out only in one segment.

3.1. Resources cumulation

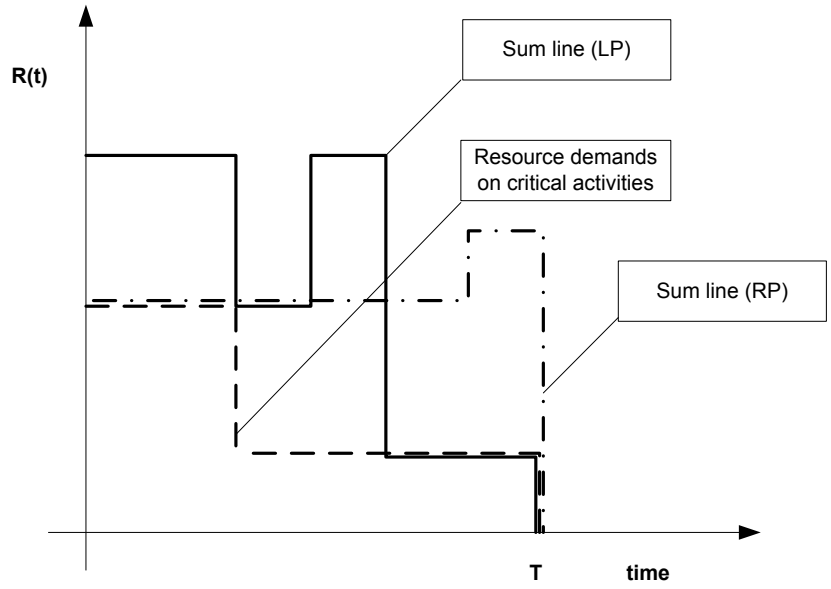
Resource cumulation stems from the results of a project time analysis. We have to recognize the first possible starting time t_i and the latest possible starting time T_i for each activity I that determine two project types:

- left-side plan (LP) – each activity I starts within the date of the earliest possible starting time t_i;
- right-side plan (RP) – each activity I starts within the date of the latest possible starting time T_i.

These plans stipulate a shift of non-critical activities in time, in the scope of their total reserve RC with no change in the project lifetime T. Let us assume a resource need r_{ij} for the activity lifetime for each activity. The need might be constant but also shall change during the time an activity is carried on.

We can identify cumulative resource need $R(t)$ for all the activities being carried on in a given time period – sum line (Fig. 3) for each time period t that is a discrete variable in a time period $(0, T)$.

Fig. 3 *Sum line of resource R*



Source: own processing

The sum line is the simplest means for planning and monitoring project resources use. Where resource use R in time is uneven, we shall balance it by shifting the starting time of each non-critical activity I within the interval (t_i, T_i).

3.2. Resource leveling

Resource leveling builds on the option of shifting non-critical activities in time and scheduling such a timetable that ensure as far as possible the most even resource use over the project lifetime avoiding exceeding given termination date. Leveling concerns extreme demands on resources. We shall define the resource use by:

- total demand on a resource R_c over the project lifetime:

$$R_c = \sum_{i=1}^{T} R(t) \tag{2}$$

- average demand on a resource in a time period:

$$\overline{R} = \frac{1}{T}\sum_{t=1}^{T} R(t) \tag{3}$$

- resource demands variance:

$$\sigma_R^2 = \frac{1}{T}\sum_{t=1}^{T} (R(t) - \overline{R})^2 \tag{4}$$

As regards resource leveling we shall use the following criteria for evenness:

- resource demands variance σ_R^2 that we strive to minimize
- minimizing maximum absolute deviation in average resource demand:

$$\max_{t\in\langle 1,T\rangle} \left| R(t) - \overline{R} \right| \tag{5}$$

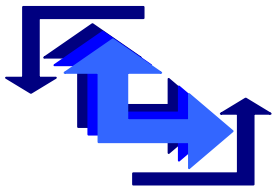
- minimizing maximum resource demand:

$$\max_{t\in\langle 1,T\rangle} (R(t)) \tag{6}$$

The choice of the criterion of evenness is to be considered individually and the resource leveling is done by applying heuristic algorithms the authors of the relevant literature present (e.g. the Burgess-Killebrew algorithm). One example [2]: *

1. Carry out CPM analysis. (CPM - Critical Path Method)
2. Set all the activities *(i,j)* first using a variable *j* from the lowest to the highest and then with the same variable *j* set them using a variable *i* from the lowest to the highest.

* Let us consider resource demands variance σ_R^2 to be a criterion for resource leveling and who we set for LP and PP.



3. Initially, all the activities are set into the date of the earliest possible starting time t_i (LP). Shift the earliest possible starting times t_i of the activities in time applying an algorithm within the scope of a total reserve *RC* starting from the last activity to the first one following the assignment from step 2.
4. Take the last activity. If not critical or having otherwise restricted beginning we then shift the activity to the most right so the resource demands squares sum σ_R^2 is less now. If more options are present we then move the activity to the most right.
5. Repeat step 4 for all the activities from the end of the row to its beginning so as we get 1st version of a resource use balance plan. The lower is a value σ_R^2 the more a resource use is in a balance. The number of shifting cycles is a heuristic decision of the subject carrying on a resource leveling.

3.3. Resource allocation

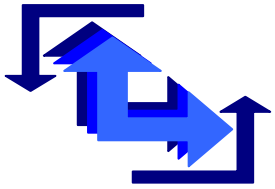
Having had done resource leveling we hence assign them to project activities. Here a situation might occur in which the resource availability is not sufficient to cover the real resource need in line with the balance plan. Such an issue might occur in particular in the context of unseparable resources.

Therefore, it is necessary to optimize in order to set the shortest possible time a project is to be implemented based on a given maximum resource availability. When optimizing resources we shall apply several heuristic methods, which simplify addressing of the task significantly. Here we present Brooks's algorithm that provide reliable results when handling this task:

Brooks's algorithm

The algorithm builds on the results of a time analysis applying CPM.

1. Let us assume a constant number of items of a resource *R* over the project lifetime.
2. Set all the project activities in a decreasing sequence considering the size of the longest path from the beginning of an activity to the end of a project.
3. Create a zero decision file that involves all the activities arising from a starting node of a digraph (initial project activities). Set these activities in a decision file considering the longest path from the beginning of an activity to the end of a project. The periods of entry *T* into a decision file is equal to 0 in this case.
4. Select the activities *(i,j)* step-wise from the decision file considering the order of the remaining longest path and set the difference $R - r(i,j)$. Let $R - r(i,j) \geq 0$ then we assume a time value *T* to be a starting date of an activity. State a termination date $(T + t_{ij})$ for the activity and at the same time remove these activities from the decision



file. As a result a resource capacity will decrease from R to $R - r(i,j)$. If the difference is $R - r(i,j) < 0$ then there is no necessary resource capacity available for the activities and thus we cannot plan the beginning and duration of them in a given time. Such activities are about to remove from the decision file and give them back to the decision-making process.

5. Given the drawdown of all activities of the decision file we shall create a new one in the shortest time T when the activities selected (completed) so far had already been completed and resource availability R enables their implementation.
6. All the activities from the previous decision file are involved in a new decision file automatically. All the activities that shall start in a time T are identified using a flowchart, assign into the decision file and align considering the longest path from the beginning to the end of the project. Given that all the previous activities had been completed the resources which had been consumed upon the implementation are now about to release. Repeat step 4 for activity selection procedure until will have selected the last activity of the project.

Conclusion

The decision-making on projects is a significant part of project portfolio management. We have to determine, which projects are to be involved in portfolio, which ones are about to keep on implementing and which ones we'd better terminate even they have not been completed yet whilst considering organization budget and goals. This includes in particular optimizing a total resource use of an organization and ensuring an optimal level of benefits. Costs and resources are basically the most common constraints when analyzing portfolio. Since these are basic constraints entering an optimization process, they have to be analyzed thoroughly.

Using resources in multiple projects in parallel and if their real availability do not follow the cumulative requirement or there is a change in timetable - all this is significantly complicating the process of planning and managing resources. In such a case a way to fix up this clash is similar as is the case in single project whilst having the projects ranked in priority order. Resources shall be preferentially allocated to a project of utmost importance (project of greater clashing). However, sometimes it is better to prioritize termination of a minor project of a less priority in order to work towards more complex project.

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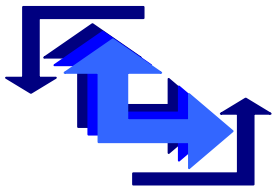

References

[1] FIALA, P.: *Projektové řízení, modely, metódy, analýzy.* 1. vyd. Professional publishing, Praha 2004. ISBN 80-86419-24-X. s. 73.

[2] GLIVIAK, F., VADKERTI, P.: *Sieťová analýza a manažment projektov*. 1. vyd. Univerzita sv. Cyrila a Metoda v Trnave. Trnava 2001. s. 37. ISBN 80-89034-01-2.

[3] DVOŘÁK, D, RÉPAL, M., MAREČEK, M.: *Řízení portfolia projektů – Nejlepší praktiky portfolio managementu*. 1. vyd. Computer Press, Brno 2011. ISBN 978-80-251-3075-9.

[4] KRÁĽ, P.: *Optimalizácia projektového portfólia s uplatnením modulu bivalentného programovania.* In: Acta Oeconomica Universitatis Selye: vedecký recenzovaný časopis. Roč. 2, č. 2 (2013), s. 105-113. ISSN 1338-6581.

Resume

The paper deals with the issue of analyzing and planning project resources that stand out as basic constraints in project portfolio optimization process. It first defines the term 'project resources' and determines basic types of project resources under the chosen constraints and underlines their importance in the optimization process. The authors have designated a new way of categorizing project resources in terms of consumption in time. The paper further presents general reference framework, which is to be applied in a process of analyzing project resources. The framework consists of cumulation, leveling and allocation of resources using Brooks's algorithm.

Key words

Project portfolio, optimization, project resources, project resources analysis

The article is an output of scientific project VEGA 1/0656/14 KLIEŠTIK, T. et al.: Research of possibilities of credit default models application in conditions of the SR as a tool for objective quantification of businesses credit risks.

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THE BRAND AND APPROACHES TO BRAND VALUATION IN THE SUPPLY CHAIN

Lenka MIKÁČOVÁ, Peter MAJERČÁK

1 Introduction

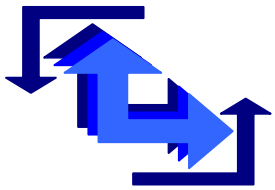
In the last quarter of the 20th century there was a dramatic shift in the understanding of the creation of shareholder value. For most of the century, tangible assets were regarded as the main source of business value. These included manufacturing assets, land and building or financial assets such as receivables and investments. They would be valued at cost or outstanding value as shown in the balance sheet. The market was aware of intangibles, but their specific value remained unclear and was not specifically quantified. Even today, the evaluation of profitability and performance of businesses focuses on indicators such as return on investment, assets or equity that exclude intangibles from the denominator. Measures of price relatives also exclude the value of intangible assets as these are absent from accounting book values.

2 The brand value

For some companies the brand is the most important asset they have. The following statement by John Stuart (chairman of Quaker, 1990) illustrates the value of brand: *"If this business were split up, I would give you the land and bricks and mortar, and I would take the brands and trademarks, and I would fare better than you."* (Clifton & Simmons, 2003)

Having a strong brand like Apple, Google, Coca-Cola, Microsoft or Mercedes Benz almost guarantees business success. Large brand owners have always been aware of value and importance of their brands and have deliberately created a series of brand characteristics that they presented to their buyers. The purchasing brand is no longer merely an acquisition of a product; it also includes an intrinsic experience of a consumer and even reflects a certain lifestyle. Even non-profit organizations have started embracing the brand as a key asset for obtaining donations, sponsorships and volunteers.

A successful brand has loyal consumers, which ultimately reflects on sales value and brand owner's market value. A continuous increase in the gap between companies' book values and their market value has brought to the recognition that the value of intangibles can be quantified. This gap has become particularly evident in the late 1980s when companies were bought at much higher premiums than their book value.



2.1 The social value of brands

The economic value of brands to their owners is now widely accepted, but their social value is less clear. Do brands create value for anyone other than their owners, and is the value they create at the expense of society at large? (Klein, 1999) The ubiquity of global mega-brands has made branding the focus of discontent for many people around the world. They see a direct link between brands and such issues as the exploitation of workers in developing countries and the homogenisation and tarnishing the virtues of the capitalist system by encouraging monopoly and limiting consumer choice. The opposing argument is that brands create substantial social as well as economic value as a result of increased competition, improved product performance and the pressure on brand owners to behave in socially responsible ways.

Competition on the basis of performance as well as price, which is the nature of brand competition, fosters product development and improvement. And there is evidence that companies that promote their brands more heavily than others in their categories do also tend to be more innovative in their categories. A study by PIMS Europe for the European Brands Association revealed that less-branded business launch fewer products, invest significantly less in development and have fewer product advantages than their branded counterparts. Almost half of the "non-branded" sample spent nothing on product R&D compared with less than a quarter of the "branded" sample. And while 26 % of non-branded producers never introduced significant new products, this figure was far lower at 7 % for the branded set.

The need to keep brands relevant promotes increased investments in R&D, which in turn leads to a continuous process of product improvement and development. Brand owners are accountable for both the quality and the performance of their branded products and services and for their ethical practices. Given the direct link between brand value and both sales and share price, the potential costs of behaving unethically far outweigh and benefits, and outweigh the monitoring costs associated with an ethical business.

A number of high-profile brands have been accused of unethical practices. Interestingly, among these are some of the brands that have been pioneering the use of voluntary codes of conduct and internal monitoring systems. This is not to say that these brands have successfully eradicated unethical business practices, but at least they are demonstrating the will to deal with the problem.

The more honest companies are in admitting the gap they have to bridge in terms of ethical behaviour, the more credible they will seem. Nike, a company once criticised for the employment practices of some of its suppliers in developing countries, now posts results of external audits and interviews with factory workers at www.nikebiz.com. The concern of

multinational companies is understandable, considering that a 5 % drop in sales could result in a loss of brand value exceeding $1 billion. It is clearly in their economic interests to behave ethically.

3 Approaches to brand valuation

Financial values have to some extent always been attached to brands and to other intangible assets, but it was only in the late 1980s that valuation approaches were established that could fairly claim to understand and assess the specific value of brands. The idea of putting a separate value on brands is now widely accepted. For those concerned with accounting, transfer pricing and licensing agreements, mergers and acquisitions and value-based management, brand valuation plays a key role in business today.

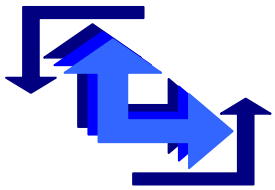
Unlike other assets such as stock, bonds, commodities and real estate, there is no active market in brands that would provide "comparable" values. So to arrive at an authoritative and valid approach, a number of brand evaluation models have been developed. Most have fallen into two categories:

- research-based brand equity evaluations,
- purely financially driven approaches.

3.1 Research-based approaches

Research-based approaches use consumer research to assess the performance of brands. Research approaches do not put a financial value on brands; instead, they measure consumer behaviour and attitudes that have an impact on the economic performance of brands. Although the sophistication and complexity of such models may vary, they all try to explain and measure consumers' perceptive measures. Through different methods of statistical modeling, these measures are arranged either in hierarchic order, to show degrees of relationship towards the brand (from awareness to preference and purchase). The disadvantage of the research-based techniques is that they do not differentiate between the effects of the brand on consumers and the effects of other factors such as research, development and design. They therefore do not provide a clear link between the specific marketing indicators and the financial performance of the brand. A brand can perform strongly according to these indicators but still fail to create financial a shareholder value.

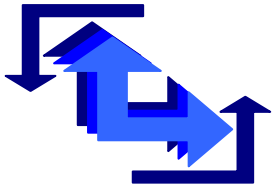
Factors that have impact on the success of the brand in the eyes of consumers are crucial for assessing the financial value of brands. However, unless they are integrated into economic models, they are insufficient for assessing the economic value of brands.



3.2 Financially driven approaches

In contrast to research-based approaches, financially driven approaches do not research consumer behaviour but are based on financial performance of a certain brand. Financially-driven approaches include:

- **Cost-based approaches** – define the value of a brand as the aggregation of all historic costs incurred while bringing the brand to its current state: that is, the development costs, marketing costs, advertising and other communication costs, and so on. Cost-based approaches fail because there is no direct correlation between the financial investment made and the value-added by a brand. Financial investment is an important component in building brand value, provided it is effectively targeted.
- **Comparables** – this approach is used to arrive at a value for brand by observing and valuing comparables of different brands. Defining a comparable is difficult as by definition they should be differentiated and thus not comparable. Comparables can provide an interesting cross-check; however, they should never be relied on solely for valuing brands.
- **Premium price** – premium price is the price paid by a buyer for improved quality of the product guaranteed by the certificate and not for product appearance. In this method, the price – premium price is calculated as the net present value of future price premiums that a branded product would command over an unbranded or generic equivalent. However, the primary purpose of many brands is not necessarily to obtain a premium price but rather to secure the highest level of future demand. This method is flawed because there are rarely generic equivalents to which the premium price of a branded product can be compared. Today, almost everything is branded, and in some cases store brands can be as strong as producer brands charging the same or similar prices. The price difference between a brand and competing products can be an indicator of its strength, but it does not represent only and most important value contribution a brand makes to the underlying business. The above-mentioned research-based and financially driven approaches are essentially one-dimensional. Research-based approaches lack financial component, while financially driven approaches lack marketing component to provide a complete and robust assessment of the economic value of brands.
- **Economic use** – these approaches are driven exclusively by brand equity measures or financial measures lack either the financial or the marketing component to provide a complete and robust assessment of the economic value of brands. The economic use approach, which was developed in 1988, combines brand equity and financial measures, and has become the most widely recognised and accepted methodology for brand valuation. It has been used in more than 3500 brands valuations worldwide. The economic use approach is based on fundamental marketing and financial principles:



- The marketing principle relates to the commercial function that brands perform within businesses. First, brand help generate customer demand; customers can be individual consumers as well as corporate consumers depending on the nature of the business and purchase situation. Customer demand translates into revenues through purchase volume, price a frequency. Second, brands secure customer demand for the long term through repurchase and loyalty.
- The financial principle relates to the net present value of future expected earnings, a concept widely used in business. The brand's future earnings are identified and then discounted to a net present value using a discount rate that reflects the risk of those earnings being realized.

To capture the complex value creation of a brand, take the following five steps:

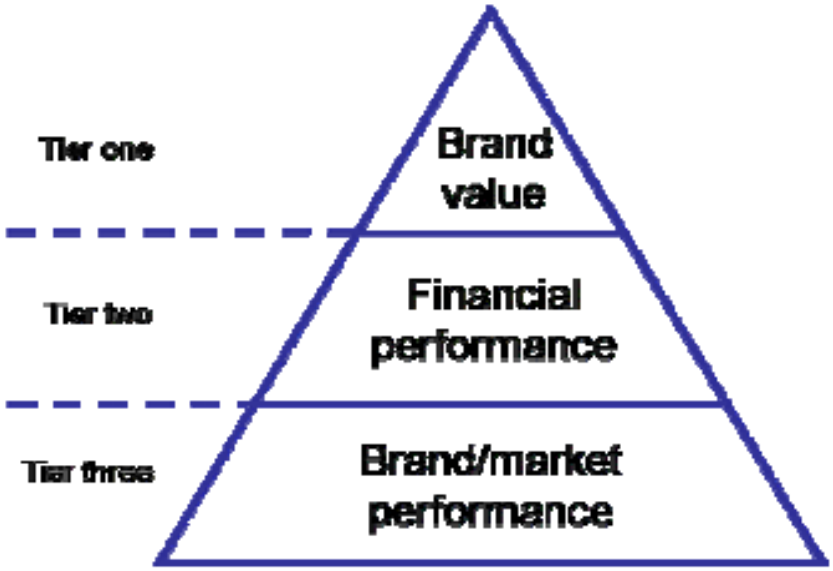
1. **Market segmentation.** Brands influence customer choice, but the influence varies depending on the market in which the brand operates. Split the brand's markets into non-overlapping and homogeneous groups of consumers according to applicable criteria such as product or service, distribution channels, consumption patterns, purchase sophistication, geography, existing and new customers, and so on. The brand is valued in each segment valuations constitutes the total value of brand.
2. **Financial analysis.** Identify and forecast revenues and "earnings from intangibles" generated by the brand for each of the distinct segments determined in step 1. Intangible earnings are defined as brand revenue less operating costs, applicable taxes and a charge for the capital employed. The concept is similar to the notion of economic profit.
3. **Demand analysis.** Assess the role that the brand plays in driving demand for products and services in the markets in which it operates and determine what proportion of intangible earnings is attributable to the brand measured by an indicator referred to as the "role of branding index". This is done by first identifying the various drivers of demand for the branded business, then determining the degree to which each driver is influenced by the brand. The role of branding index represents the percentage of intangible earnings that are generated by the brand. Brand earnings are calculated by multiplying the role of branding index by intangible earnings.
4. **Competitive benchmarking.** Determine the competitive strengths and weaknesses of the brand to derive the specific brand discount rate that reflects the risk profile of its expected future earnings (this is measured by an indicator referred to as the "brand strength store". This comprises extensive competitive benchmarking and structured evaluation of the brand's market, stability, leadership position, growth trend, support, geographic footprint and legal prosperity.

5. **Brand value calculation.** Brand value is the net present value (NPV) of the forecast brand earnings, discounted by the brand discount rate. The NPV calculation comprises both the forecast period and the period beyond, reflecting the ability of brands to continue generating future earnings.

The economic use approach provides the multidimensionality to brand valuation as it combines brand equity with financial measures. Companies such as Interbrand and MillwardBrown compile a list of most valuable brands each year which is based on economic principles and replies to the fundamental question: how much more valuable is the business because it owns certain brands. This brand valuation includes both a marketing measure that reflects the security and growth prospects of the brand and a financial measure that reflects the earnings potential of the brand.

The total brand value comprises several tiers which when put together resemble a pyramid.

Fig. 1 *Brand valuation pyramid tiers*

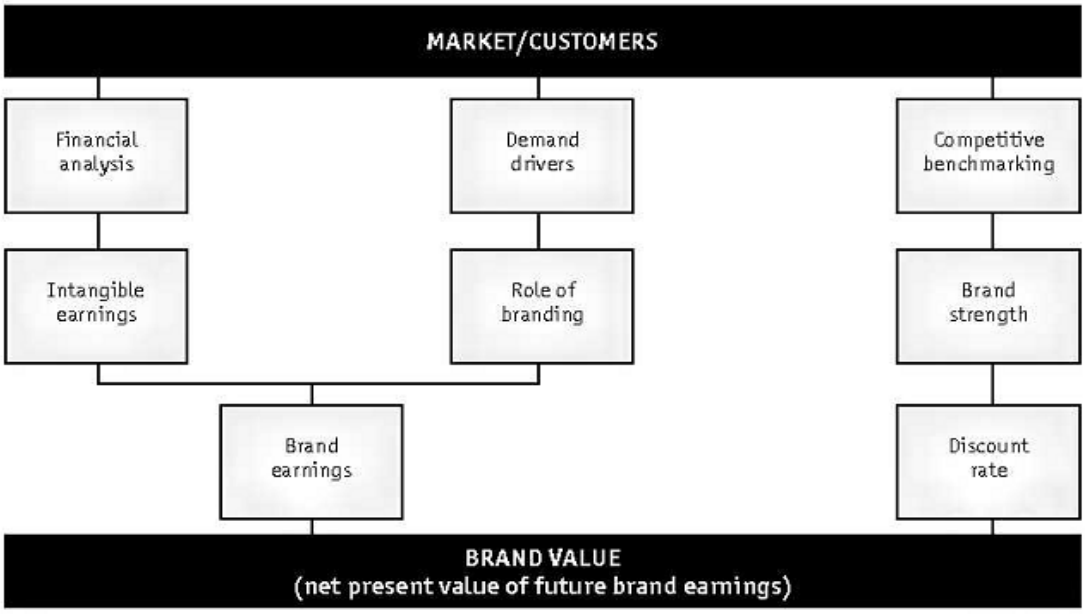


Source: Keller, K.L. (2001). *Building customer-based brand equity*. Marketing Management, 2001.

Brand value often identified with its most visibly attractive elements, but that is just the first tier (the top of pyramid) of the overall brand value. Tier two contains financial measures such as brand's profitability, income and tax, while tier three contains measures of brand strength and market conditions. Given this concept of economic worth, the value of a brand reflects not only what earnings it is capable of generating in the future, but also the

likelihood of those earnings actually being realized. Interbrand's valuation model is shown in Figure 2.

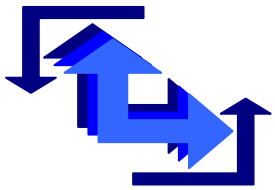
***Fig. 2** Interbrand's valuation model*



Source: CLIFTON, R. & SIMMONS, J. (2003). *Brands and Branding.* London - Profile Books, 2003.

4 The brand equity

Brands represent enormously valuable pieces of legal property, capable of influencing consumer behaviour, being bought and sold, and providing the security of sustained future revenues to their owner. The value directly or indirectly accrued by these various benefits is often called brand equity the concept of brand equity has interested academics and practitioners for more than a decade, primarily due to the importance in today's marketplace of building, maintaining and using brands to obtain strategic advantage. The concept refers to the basic idea that a product's value to consumers, the trade and the firm is somehow enhanced when it is associated or identified over time with a set of unique elements that define the brand concept. (Erdem et al., 1999) Brand equity has been described as the benefit endowed by the brand to the product. (Farquhar, 1989) This benefit can be viewed and analysed from the perspective of either the consumer or the firm. (Shocker & Weitz, 1988) The value of a brand to consumers is generally referred to as consumer-based brand equity. Brand equity research in has suggested that brand associations, brand awareness, perceived quality, brand loyalty, and other proprietary brand assess (e.g., patents) underlie brand equity. Keller has also emphasized brand awareness and associations as key underpinnings of consumer-based brand equity. This view of brand equity is rooted in



cognitive psychology and focuses on consumer cognitive processes. (Erdem et al., 1999) The value of a brand and thus its equity is ultimately derived in the marketplace from the words and actions of consumers. Consumers decide with their purchases, based on whatever factors they deem important, which brands have more equity than other brands. Although the details of different approaches to conceptualize brand equity differ, they tend to share a common core: All definitions typically either implicitly or explicitly rely on brand knowledge structures in the minds of consumers individuals or organizations as the source or foundation of brand equity. In other words, the real power of a brand is in thoughts, feelings, images, beliefs, attitudes, experiences and so on that exist in the minds of consumers. (Keller, 2003)

Sources of brand equity arise from the customer mind-set. Customer based brand equity occurs when consumer has a high level of awareness and familiarity with the brand and holds some strong, favourable, and unique brand associations in memory. Recall that brand awareness is related to the strength of the brand in symbol, character, packaging, and slogan) under different conditions. In addition, recognition processes require that consumers be able to discriminate a stimulus a word, object, image, or whatever as something variety of circumstances and can involve identification of any of the brand elements. (Keller, 2003) According to Jeremy Bullmore (former chairman of J Walter Thompson, author and columnist) -"Consumers build an image (of a brand) as birds build nests. From the scraps and straws they chance upon." Thus, a brand name, logo, a single tune, packaging or any visual differentiation or any unique feeling/experience with the brand or any type of marketing activity works like a clue for consumer to preserve an image or perception about the brand in the memory which helps consumer to recall and recognize the brand under different conditions.

A brand element is visual or verbal information that serves to identify and differentiate a product. The most common brand elements are names, logos, symbols, characters, packaging and slogans. Brand elements can be chosen to enhance brand awareness or facilitate the formation of strong, favourable and unique brand associations. The best test of the brand-building contribution of brand elements is what consumers would think about the product or service if they only knew about its brand name, associated logo and so forth.

Because elements have different advantages, a sub-set or even the entire possible brand elements are often employed. (Keller, 2008) A number of options and criteria relevant for choosing brand elements have been discussed above. Now, some common brand elements will be explored to identify how they work together or individually to contribute to brand equity.

5 Conclusion

Brand is a mental game where each element tells a story about the brand itself and these stories are destined an inevitable part of the brand management, which can be done by positioning and integrated marketing communication.

However, this differentiation starts from developing each brand element distinctively to avoid the „me too approach“. Brand was born to separate a group of products from that of others; but nowadays, brand is used by consumers to differentiate them within society. It has become a public property and consumers have the right to know the differentiating quality of the brand during purchase. Consumers depend on the brand so much that even in a grocery shop, brand works as shorthand to full their shopping cart within shortest possible time. Thus, elements of brand need to be visible and memorable to consumers so that they could recognize their desired brand within a crowd. Since brand is not all about exchange, it is about how to create a profound relation with the consumer. The basis of brand equity lies in the relationship that develops between a consumer and the differentiating offerings of a brand. In some cases, product itself is so innovative that brand can easily seek a premium positioning in the market. However, in fast moving consumer goods industry, differentiation is very challenging to create and vital to strike in consumer's memory. Distinctive acts as clue to recall and recognize the brand under different circumstances.

Exploring some successful and strong brands in the market, it can be concluded that collective strength of brand elements always contributes to build as well as reinforce brand equity since the birth of the brand. As a part of the successful brand management, immense focus and research are required to work out clutter breaking image of the brand.

Paper is an output of project VEGA MŠ a SAV č. 1/0931/12 „Uplatnenie Teórie obmedzenia (TOC) v logistickom riadení výroby podniku“.

References

[1] AAKER, D. A. (2003). *Brand building budování značky.* Brno: Computer Press. 312 p.

[2] AAKER D. A. (1991). Selecting, creating and maintaining associations in managing brand equity, capitalizing on the value of brand name. New York: The free press.

[3] AAKER D. A. (1996). *Building Strong Brands*. Free Press: New York, 1996.

[4] CLIFTON, R. – SIMMONS, J. (2003). *Brands and Branding*. London: Profile Books Ltd. 284 p.

[5] ERDEM, T., SWAIT, J., BRONIARCZYK, S., CHAKRAVARTI, D., KAPFERER, J. N., & KEANE, M. (1999). *Brand equity, consumer learning and choice.* Marketing Letters. P 301-318.

[6] FARQUHAR, P. (1989). *Managing brand equity*. Marketing Research. P. 24-33.

[7] FOSTER, R. – KAPLAN, S.: (2001). Creative Destruction: Why Companies That Are Built to Las Underperforms the Market – And how successfully Transform Them. Crown Business. 384 s.

[8] HAIGH, D. (2002). *Oceňovaní značky a jeho význam.* Praha: Management Press. 350 p.

[9] HEALEY, M. (2008). *Co je branding.* Praha: Slovart. 256 p.

[10] KAPFERER, J. N. (2005). *The New Strategic Brand Management.* London: Kogan-Page.

[11] KAMPF, R.; CEMPÍREK, V.; KAMPF, R. *Zasílatelství*. Pardubice: Univerzita Pardubice, 2005. ISBN 80-7194-745-8.

[12] KELLER, K. L. (2001) *Building customer-based brand equity: A blueprint for creating strong brands*. Marketing Research Institute, Report Summary. p. 38

[13] KELLER, K. L. (2003). *Brand Synthesis: The multidimensionality of brand knowledge*. Journal of Consumer research Vol. 29, p. 595-600.

[14] KELLER, K. L (2003). *Strategic brand management: Building, measuring and managing brand equity.* Upper Saddle River, NJ: Prentice Hall.

[15] KELLER, K. L. (2007). *Strategické řizení značky.* Praha: Grada Publishing. 796 p.

[16] KELLER, K. L. (2008). *Strategic brand management: Building, measuring, and managing brand equity.* (3ed.). Upper Saddle River, NJ: Prentice Hall.

[17] KELLER, K. L., APÉRIA, T. and GEORGSON, M. (2008). *Strategic Brand Management: A European perspective*. Harlow, GB: Pearson Education Limited.

[18] KLEIN, N. (1999). *No logo*. Picador, 1999.

[19] KOEHN, N. F. (2001). Brand New: How Entrepreneurs Earned Consumers' Trust from Wedgwood to Dell. First Edition.Harvard Business Review Press. 448 p.

[20] KOTLER, P. (1998). *Marketing management.* Praha: Grada Publishing. 854 p.

[21] KOTLER, P. & KELLER, K. L. (2006). *Marketing management.* Praha: Grada Publishing. 788 p.

[22] KRIŽANOVÁ, A. et al. (2010). *Medzinárodný marketing.* Žilina: GEORG. 263 p.

[23] LERMAN, D. & GARBARINO, E. (2002). *Recall and recognition of brand names: A comparison of word and nonword name types.* Psychology & Marketing, 19(7/8), 621.

[24] OLINS, W (2009). *O značkách.* Praha: Argo, Dokořán. 253 p.

[25] PŘÍBOVÁ, M et al. (2000). *Strategické řízení značky – Brand management.* Praha: EKOPRESS, 220 p.

[26] SHOCKER, A. D. & WEITZ, B. (1988). *A perspective on brand equity principles and issues, In: Defining, measuring and managing brand equity.* Conference Summary (Report no 88-104). Cambridge, Ma: Marketin Science Institute, 2-4.

[27] ŠTENSOVÁ, A. et al. (2006). *Manažment značky – vybrané problémy.* Bratislava: Ekonom. 110 p.

[28] TAYLOR, D. (2007). *Brand management.* Brno: Computer Press. 226 p.

Resume

Brands are generally a company's most valuable asset and the means through which profit and income are generated. Identifying what drives this value enables to increase a brand's performance, resulting in increased revenue, larger market share and higher profits. Brand valuation helps analyze and plan for this, which is what makes it useful. Brand is rarely explicitly and adequately valued and it appears very rarely on financial statements. Even when it does appear, the numbers don't have a universally recognized economic and market foundation.

Key words:

Brand; value; valuation approaches

JEL classification: *G00*

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FINANCING AND TENDERING PUBLIC PASSENGER TRANSPORT

Miloš POLIAK, Štefánia SEMANOVÁ, Peter VARJAN

1 Introduction

The objective of providing transport services is satisfaction of inhabitants' transport requirements in terms of their basic needs such as commuting to work, school, or health care facilities. Majority of these services cannot be provided on a commercial basis because they are unprofitable from the view of public service operators. Therefore, it is necessary to ensure financing transport services from public funds.

Currently, the need for funding public passenger transport is constantly growing, and therefore, it is necessary to use appropriate mechanisms for award of contracts and implement proper elements into contractual relationships. The elements should motivate the public service operators to efficient and economical provision of transport services, in particular to reducing costs, increasing service quality and thereby the increasing interest in public transport from passengers' side.

2 Overview of financing public passenger transport in the selected EU states

2.1 The Slovak Republic

Provision of transport services by public bus service is ordered and funded from the position of public authorities – cities or self-governing regions. During the period 2005 – 2012, the compensation of economically justified costs plus a reasonable profit was paid to public service operators based on the direct award of contracts. In the SR, the level of reasonable profit is set in the range from 3.5 % to 5 % of economically justified costs. Area of financing public rail transport is within the competence of state despite the efforts to transfer some competence to self-governing regions. Table 1 provides the overview of funds that was paid to public service operators while providing transport services.

Transport services are funded from public budgets which are, however, limited resources of funding. The need for funds to public transport is increasing (Tab.1) while the number of passengers is decreasing. Therefore, public authorities (state, self-governing regions, cities) have to look for the opportunities to address this situation, in particular by optimization of providing transport services such as reduce the proportion of concurrency of

lines and motivate public service operators to provide services which contribute to keeping passengers in public passenger transport.

Tab. 1 *Overview of financing public passenger transport in the SR in mil. EUR*

YEAR	***2000***	***2005***	***2006***	***2007***	***2008***	***2009***	***2010***	***2011***
Public bus service	26,453	37,773	51,836	65,536	71,147	97,712	99,794	106,38
Rail passenger transport	161,62	116,60	139,77	159,85	165,97	270,33	228,11	205,0

Source: [4]

2.2 The Czech Republic

The important role in payment of compensations plays Ministry of Transport (MD ČR) which approves the financial model of costs, revenue and net income of the carrier when drafting state budget for the following year. The Ministry of Finance (MF ČR) also enters into decision-making process for compensations in case of reducing provision of transport services due to financial reasons. If such performance reduction represents more than 10 %, MF ČR will decide to grant subsidies or make budget changes for providing transport services from state budget. [15]

Majority of services in the Czech Republic was directly awarded to public service operators. Procurement of bus service as well as its financing is in the competence of self-governing regions and cities. Table 2 shows an amount of subsidies provided for bus service in public interest (urban public transport is not included in the table). Procurement of rail passenger transport as well as its financing is in the competence of state and self-governing regions. Table 3 provides the overview of subsidies granted.

Tab. 2 *Subsidies to bus service in public interest in mil. CZK*

YEAR	***2005***	***2007***	***2008***	***2009***	***2010***	***2011***
Budgets of regional authorities	3 691	3 816	4 351	4 358	4 823	4 712
Budgets of cities	640	253	332	380	370	368
Total	4 331	4 069	4 683	4 918	5 193	5 080

Source: [5]

Tab. 3 *Subsidies to rail transport in public interest in mil. CZK*

YEAR	***2005***	***2007***	***2008***	***2009***	***2010***	***2011***
State budget	2 620	3 491	4 035	3 997	4 070	4 074
Subsidies from regional authorities	4 546	4 529	5 085	8 377	8 458	8 627
Total	7 166	7 334	8 020	12 374	12 528	12 746

Source: [5]

2.3 Ireland

In the Ireland, the subsidies are paid by the National Transport Authority to the following 3 State-owned operators for bus and rail services provided under public services contracts:

- Irish Rail which operates rail services in Ireland including services in urban areas,
- Dublin Bus which operates bus services in the capital city,
- Bus Éireann which operates inter-city, regional and city services throughout Ireland.

State funding for the day-to-day operation of bus and rail services that are not commercially viable is managed through public service contracts. In table 4, there are subventions totaling which was paid to the operators.

Tab. 4 *Redistribution of grants for transport operators in the Ireland per year 2012*

Operators	Amount of the grant [mil. €]
Irish Rail	166,4
Dublin Bus	74,8
Bus Éireann	36,9
Total	***278,1***

Source: [8]

2.4 Austria

The public authorities are responsible for organizing and financing public transport [6]:

- *Fedral authority* – which is responsible for guarantee a basic supply of services in local and regional public transport by rail to the extent of the ordered services.
- *Regional and local authorities* –which are responsible for plan a demand-oriented transport service (reduction, expansion or restructuring of transport services).

Therefore, public rail transport is organized by the federal and the provincial governments whereas bus services are only in the competence of provincial governments or municipalities. The federal authority, public rail passenger services were awarded directly for a 10 years.

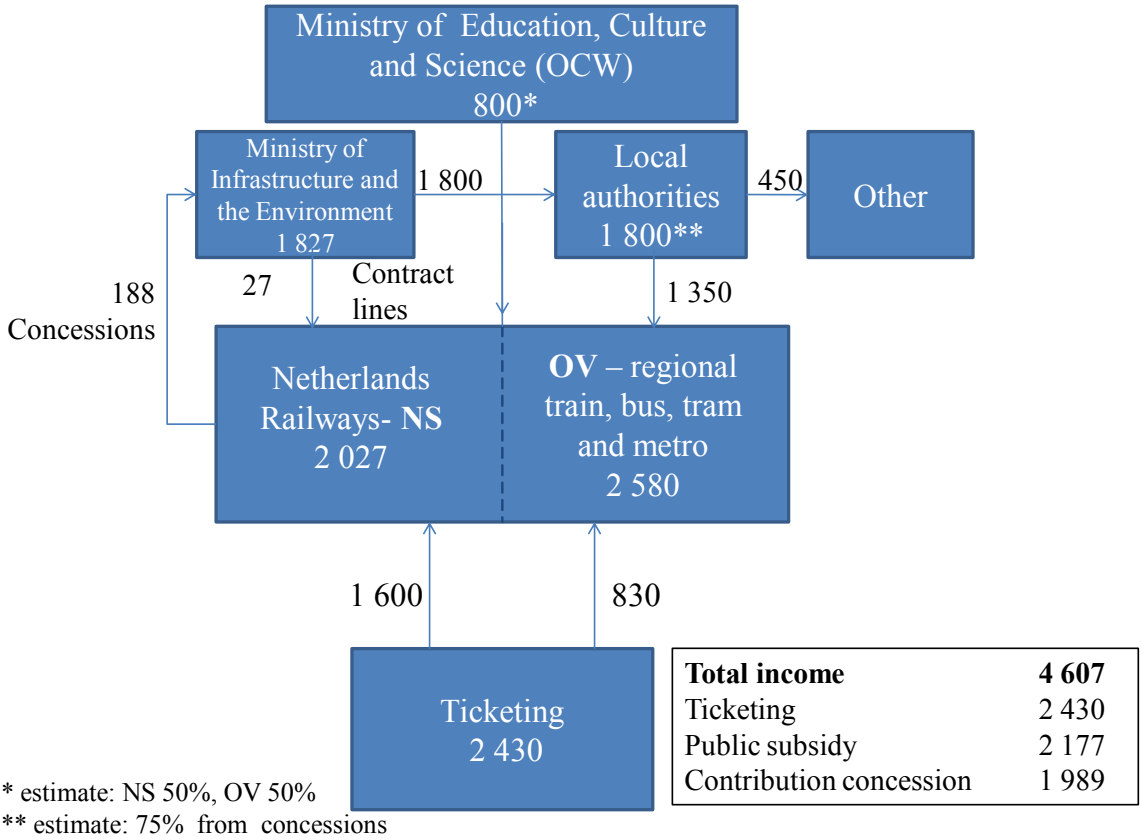
The sums for financing public transport as far as the federal authorities are concerned are part of the federal budget and therefore raised by taxes. Provinces and municipalities finance public transport through fiscal/financial equalization and according to the possibilities of their budgets. There also exist contracts between provinces and the federal authority in order to obtain co-financing by the federal government for certain services (e.g. special tariffs for students, free ride for pupils and apprentices …). On a local basis several taxes and fees exist in order to provide public transport. In Vienna, for example, the local

authority raises a tax from companies on all salaries in order to provide a metro system. The over-all ratio of direct revenue from ticket sales is around 30-50%.

2.5 Netherlands

In the Netherlands subsidies for public passenger transport in absolutely terms are €4 607 million per year (Fig 1); of which the financial income to NS (Netherlands Railways) is €2 027 mln and the other Public transport Companies (regional train, bus, tram, metro) is €2 580 mln. Total subsidies consist from 2430, which comes from ticketing and from €2 177 mln, which comes from public subsidies. Public grants consist from €27 mln from central government subsidies to a few not yet decentralized regional railway services, grant €800 mln is a subsidy from the ministry of Education to a public transport card for students and grant €1 350 mln is an estimated figure of 75% of the total of decentralized budget (€1 800 mln) from the central government to the provinces/regions for regional transport policy.

Fig. 1 *Income of public passenger transport in Netherlands in 2011*

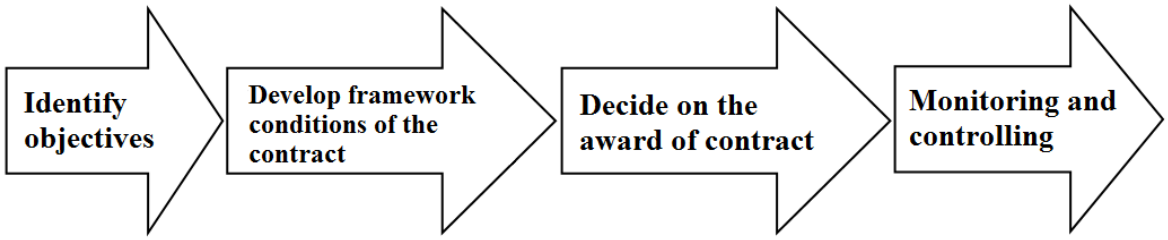


Source: [3]

3 Providing transport services by public passenger transport

A correctly concluded contractual relationship allows to create a strong partnership through which the public authority can achieve fulfilling political goals and efficient management of funding transport. The key factor in procurement of transport services is an adequate regulatory framework and conditions of contracting. Procurement process of transport services is complex and consists of several procedural steps that must be done from position of public authorities (Fig. 2).

Fig. 2 *Procedure of public authority while contracting*



Source: [13]

3.1 Identification of objectives

Good service quality can be achieved through the clearly defined objectives. At strategic level, these objectives can be economic (maximize the effectiveness and efficiency of resource use in providing services), environmental (reduce the negative impacts of transport on the environment), social (ensure that all people have the opportunity of mobility regardless of their personal situation), governmental (give people the opportunity to influence the travel policy and thus to ensure responsible planning and process of service delivery).[12] Subsequently, the objectives should be confronted with the local conditions.

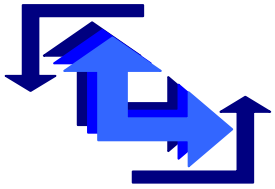
3.2 Drafting contract

Forms of individual contracts differ in an allocation of risks between contractual parties and the resulting structure of payments.

Risk allocation

Depending on the risk allocation there are the following contract forms:

- *management contract* – the public authority bears cost and revenue risk and the public service operator bears no risk,
- *gross cost contract* – the public authority bears revenue risk and the public service operator bears cost risk,
- *net cost contract* – both risks, cost and revenue, are borne by the public service operator.



Scope of the contract

In terms of the scope of the contract, the public authority can decide on:

- *route contracts* – used for a specific bus line or can include a group of shorter bus lines located close to each other,
- *network contracts* – these contracts cover whole city territory and network of city public transport or they are related to more transport modes such as metro, bus, and tram,
- *sub-network contracts* – related only to a certain part of city (e.g. suburb of city) and only one mode of transport.

Duration of contract period

When designing the length of contract period the public authority should takes into account the level of revenue risk borne by the operator in order to allow him to develop market activities for increasing the number of passengers.

Payment structure

The payments can represent lump-sum payments (determined in contract before performance realization) or variable payments (dependent on motivational elements incorporated in the contract and calculated based on determined formulas in relation to fulfilling the objectives).

Financial incentives

Introducing incentives into contractual relationships extends the simple and unambiguous breakdown of contracts according to the risk allocation to more complex division. Therefore, it cannot be always clearly stated that a given contract is the gross cost contract or net cost contract. The division according to the risk allocation and incentives can be seen in Figure 3. These contracts represent commonly used contract forms abroad.

The award of contract

The foundation of any legislation on procurement of transport services is the principle of non-discrimination, proportionality, transparency and equal treatment. The contract can be awarded directly or through competitive tendering.

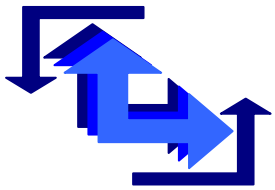


Fig. 3 *Division of contracts according to the risk allocation and incentives*

COST RISK	REVENUE RISK			
		Public authority	***Sharing***	***Public service operator***
	Public authority	**Management contract**	Other combination of incentives	
	Sharing	**Gross cost contract with a shared risk of operational costs**	Other combination of incentives	Other combination of incentives
	Public service operator	**Gross cost contract**	**Gross cost contract with the passenger incentives** **Net cost contract with a shared revenue risk**	**Net cost contract** **Super incentive contract**

Source: [12]

4 The impact of competitive tendering on the costs of public authority

In December 2009, the new Regulation (EC) 1370/2007 came into force and brought the important basic rules for competitive tendering in providing transport services in public interest. The regulation brought mainly changes in area of the restrictions on direct award of contracts. Given that the contracts related to providing transport services have a high value in practice, also in the SR, it is necessary to switch from direct award of contracts to competitive tendering.

Economic impact of competitive tendering is a frequent topic in area of providing transport services in recent years. It should be noted that in practice there are differences between cost savings achieved after the first round of competitive tendering and cost savings in subsequent rounds of competitive tendering. Table 5 shows the cost savings achieved in mentioned cases.

Eventually, it can be concluded that there are still cost savings related to competitive tendering despite slightly increase of costs in subsequent rounds compared to the first round. However, the success of given awarding mechanism is also measured by an increase in number of passengers, improving service quality or increasing range of services provided.

Tab. 5 *Cost savings achieved after 1th and subsequent rounds of competitive tendering*

The results of the 1th round of competitive tendering			
Country	**City**	**The start and gradual introducing competitive tendering**	**Unit cost savings in %**
Great Britain	London	1985 - 2000	51%
	Rest of GB	1986 - 1999	54%
Norway	Lillehammer	1994	21%
Sweden	Stockholm	1989	20 % - 32 %
	Helsingborg	1992	27%
Finland	Helsinki	1995	17 % - 34 %
Denmark	Copenhagen	1990 - 2002	24 %
Netherlands	Amersfoort	2002	37 %
Italy	Rome	2001	8 %
Australia	Perth	1995 - 1998	22 %
The results of subsequent rounds of competitive tendering			
Great Britain	London	2000 - 2001	58 % - 63 %
	Rest of GB	1998 -2002	10 % - 20 %
Norway	Lillehammer	1996 - 2000	45 %
		2000 - 2001	33 %
Finland	Helsinki	1997 - 1998	1 % - 3 %
		2000 - 2001	9 % - 15 %
Denmark	Copenhagen	1990 - 2003	-13%

Source: [2]

5 Conclusion

Funds for operation of public passenger transport are obtained either from state or local budgets. The need for funds into transport is increasing while the number of passengers is decreasing. Therefore, the public authorities (state, self-governing regions and cities) must look for the opportunities for solving this situation; mainly by optimisation of providing transport services. The Regulation (EC) 1370/2007 have brought the changes mainly in area of direct awarding of contracts in providing transport services. Competitive tendering appears as an appropriate mechanism, the introduction of which brought cost savings. Thanks to the cost savings it might be possible to release funds for the provision of any additional services or expanding the area of interest.

References

[1] Čtvrletní přehledy základních ukazovatelů https://www.sydos.cz/cs/ctvletpr.htm.

[2] HENSHER, D. A. – WALLIS, I. P.: Competitive Tendering as a Contracting Mechanism for Subsidising Transport. Journal of Transport Economics and Policy, 39, Part 3, s. 295 – 321.

[3] Ministry of Infrastructure and the Environment – Netherlands.

[4] Ministry of Transport, Construction and Regional Development of the Slovak Republic.

[5] Ministry of Transport of the Czech Republic.

[6] Ministry for Transport, Innovation and Technology – Austria.

[7] Nariadenie Európskeho parlamentu a Rady (ES) č. 1370/2007 o službách vo verejnom záujme v železničnej a cestnej osobnej doprave, ktorým sa zrušujú nariadenia Rady (EHS) č. 1191/69 a (EHS) č. 1107/70.

[8] National Transport Authority – Ireland.

[9] POLIAK, M. – KONEČNÝ. V. Trh hromadnej osobnej dopravy a jej financovanie. 1. vyd. Žilina : Žilinská univerzita v Žiline, 2009, 176 s. ISBN 978-80-8070-999-0.

[10] SEMANOVÁ, Š. – POLIAK, M. The impact of competitive tendering on the costs of competent authorities related to service provision. TRANSCOM 2013 : 10-th European conference of young research and scientific workers : Žilina, June 24-26, 2013, Slovak Republic. - Žilina: University of Žilina, 2013. - ISBN 978-80-554-0691-6. - S. 201-204.

[11] SEMANOVÁ, Š. Risk management in providing transport services by public passenger transport. Logistika – Ekonomika – Prax 201: 2. ročník medzinárodnej vedeckej konferencie: Žilina, 26. november 2013, Slovenská republika. ISSN 1336-5851, s. 114-119.

[12] KAMPF, R.; CEMPÍREK, V.; KAMPF, R. Zasílatelství. Pardubice: Univerzita Pardubice, 2005. ISBN 80-7194-745-8.

[13] STANLEY, J. – VAN DE VELDE, D. (2008): Risk and Reward in Public Transport Contracting. Research in Transport Economics, 22, č. 1, s. 20 – 25.

[14] KAMPF, R., PRŮŠA, P., SAVAGE, C. Systematic location of the public logistic centres in Czech Republic. (2011) Transport 26 (4) PP. 425 – 432, ISSN: 16484142S.

[15] VAN DE VELDE, D. – BECK, A. – VAN ELBURG, J. – TERSCHUREN, K. Contracting in Urban Public Transport. Amsterdam: European Commission, 123 s.

[16] Varjan, P.Financing public passenger transport in the chosen states of the EU. Logistika – Ekonomika – Prax 201: 2. ročník medzinárodnej vedeckej konferencie: Žilina, 26. november 2013, Slovenská republika. ISSN 1336-5851, s. 27-32.

[17] STOPKA, Ondrej a Jiří KOLÁŘ. Návrh využitia inovatívnej technológie v rámci kombinovanej dopravy na území Slovenska. In *Logi 2013: sborník příspěvků*. 1. vyd. Brno: Vysoká škola technická a ekonomická v Českých Budějovicích, 2013. s. 239-247, 9 s. ISBN 978-80-7468-059-5.

[18] Zákon č. 194/2010 ze dne 20. května 2010 o veřejných službách v přepravě cestujících a o změně dalších zákonů.

Resume

The paper deals with an issue of providing transport services by public passenger transport. The first part provides an overview of financing public passenger transport in the SR and in the selected states of the EU. Other part of the paper describes procedures when contracting. In conclusion, the paper deals with competitive tendering and its impact on the costs of public authorities.

Key words

Financing, competitive tendering, transport services

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THE LOGISTICS PERFORMANCE INDEX METHODOLOGY

Ivana ŠIMKOVÁ, Ondrej STOPKA

1 Introduction

The Logistics Performance Index is based on a worldwide survey of operators on the ground (global freight forwarders and express carriers), providing feedback on the logistics "friendliness" of the countries in which they operate and those with which they trade. They combine in-depth knowledge of the countries in which they operate with informed qualitative assessments of other countries with which they trade, and experience of global logistics environment.

The LPI measures on-the-ground trade logistics performance – year 2012, in 155 countries - helping national leaders, key policymakers, and private sector traders understand the challenges they and their trading partners face in reducing logistical barriers to international commerce.

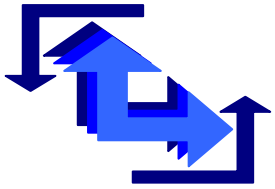
World Bank conducts the LPI Survey every two years to improve the reliability of the indicators and to build a dataset comparable across countries and over time.

2 Logistics Performance Index (LPI)

The LPI consists therefore of both qualitative and quantitative measures and helps build profiles of logistics friendliness for these countries. It measures performance along the logistics supply chain within a country and offers two different perspectives:

- **International LPI provides** qualitative evaluations of a country in six areas by its trading partners - logistics professionals working outside the country.
- **Domestic LPI provides** both qualitative and quantitative assessments of a country by logistics professionals working inside it. It includes detailed information on the logistics environment, core logistics processes, institutions, and performance time and cost data. [1]

A multidimensional assessment of logistics performance, the LPI compares the trade logistics profiles of 155 countries and rates them on a scale of 1 (worst) to 5 (best). The ratings are based on 6,000 individual country assessments by nearly 1,000 international



freight forwarders, who rated the eight foreign countries their company serves most frequently. The LPI's six components include:

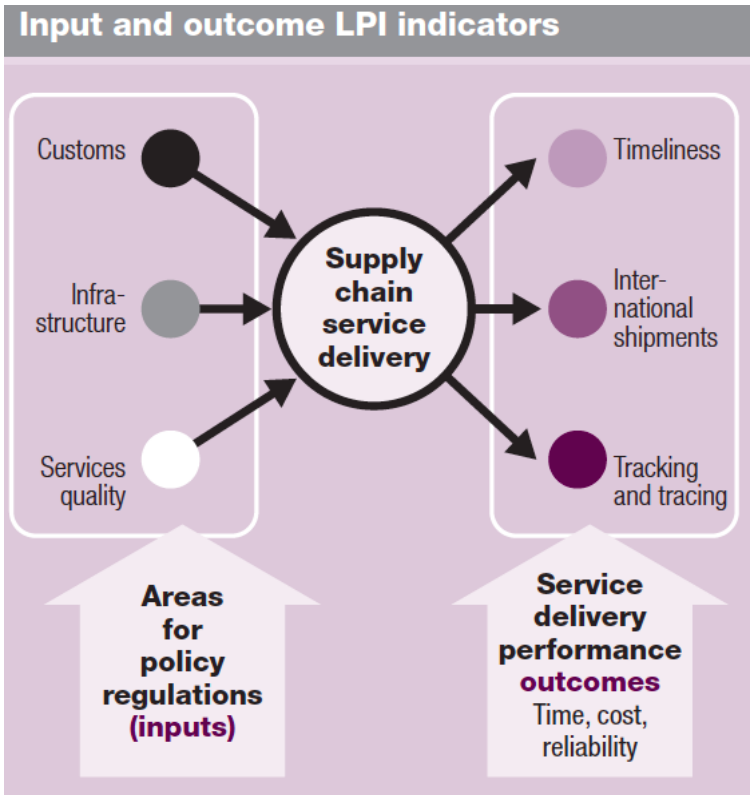
- The efficiency of the clearance process (speed, simplicity, and predictability of formalities) by border control agencies, including customs.
- The quality of trade- and transport-related infrastructure (ports, railroads, roads, information technology).
- The ease of arranging competitively priced shipments.
- The competence and quality of logistics services (transport operators, customs brokers).
- The ability to track and trace consignments.
- The frequency with which shipments reach the consignee within the scheduled or expected delivery time.

The components were chosen based on recent theoretical and empirical research and on the practical experience of logistics professionals involved in international freight forwarding. Earlier methodologies developed in 1993 used a survey format, a 2-point scale, and open-ended questions — to measure the perceived importance and influence of different component attributes affecting the logistical friendliness of countries.

The methodology was refined with contributions from interviews conducted for the Trade and Transport Facilitation Audits performed by the World Bank and others over more than a decade. The figure 1 maps the six LPI indicators in two main categories:

- Areas for policy regulation, indicating main inputs to the supply chain (customs, infrastructure, and services).
- Supply chain performance outcomes (corresponding to LPI indicators of time, cost, and reliability — timeliness, international shipments, and tracking and tracing).

Fig. 1 *Input and outcome LPI indicators*



Source: [5]

The LPI uses standard statistical techniques to aggregate the data into a single indicator. This single indicator can be used to compare countries, regions, and income groups. It can also be used for country-level work.

Because operators on the ground can best assess these vital aspects of logistics performance, the LPI relies on a structured online survey of logistics professionals from the companies responsible for moving goods around the world: multinational freight forwarders and the main express carriers.

Freight forwarders and express carriers are those best able to assess how countries perform. And their views matter, directly affecting the choice of shipping routes and gateways and influencing firms' decisions on production location, choice of suppliers, and selection of target markets. Their participation is central to the quality and credibility of the LPI, and their involvement and feedback have been essential in developing and refining the survey in this third edition of the LPI

3 The LPI Methodology

Because logistics has many dimensions, measuring and summarizing performance across countries is challenging. Examining the time and costs associated with logistics processes - port processing, customs clearance, transport, and the like - is a good start, and in many cases this information is readily available. But even when complete, this information cannot be easily aggregated into a single, consistent, cross-country dataset, because of structural differences in countries' supply chains. Even more important, many critical elements of good logistics - such as process transparency, service quality, predictability, and reliability - cannot be assessed using only time and cost information.

3.1 Constructing the international LPI

The first part of the LPI survey (questions 10–15) informs the international LPI. Each survey respondent rates eight overseas markets on six core components of logistics performance. The eight countries are chosen based on the most important export and import markets of the country where the respondent is located, on random selection, and — for landlocked countries — on neighboring countries that form part of the land bridge connecting them with international markets. The method used to select the group of countries rated by each respondent varies by the characteristics of the country where the respondent is located (*Tab. 1*).

***Tab. 1** Methodology for selecting country groups for survey respondents*

	Respondents from low – income countries	**Respondents from middle – income countries**	**Respondents from high – income countries**
Respondents from coastal countries	Five most important export partner countries + Three most important partner countries	Three most important export partner countries + The most important import partner country + four countries randomly one from each country group: Africa East Asia and Central Asia Latin America OECD and Europe less Central Asia	Two countries randomly from a list of five most important import partner countries + Four countries randomly, one from each country group: Africa East Asia and Central Asia Latin America OECD and Europe less Central Asia + Two countries randomly from the combined country groups a, b, c, and d

	Respondents from low – income countries	Respondents from middle – income countries	Respondents from high – income countries
Respondents from landlocked countries	Four most important export partner countries + Two most important import partner countries + Two land – bridge countries	Three most important export partner countries + One most important import partner country + Two land – bridge countries + Two countries randomly one from each country group: Africa, East Asia and Central Asia, and Latin America OECD and Europe less Central Asia	Two countries randomly from a list of five most important import partner countries + Four countries randomly, one from each country group: Africa East Asia and Central Asia Latin America OECD and Europe less Central Asia + Two countries randomly from the combined country groups a, b, c, and d

Source: [5]

Respondents take the survey online. The 2012 survey engine builds a set of countries for the survey respondents that are subject to the rule set (see figure 2). After 200 surveys, the USR approach is introduced into the engine's process for country selection. For each new survey respondent, the Uniform Sampling Randomized (USR) approach solicits a response from a country chosen at random but with non- uniform sampling - with weights chosen to evolve the sampling toward uniform probability. Specifically, a country i is chosen with a probability (N – ni) / 2N, where ni is the sample size of country i so far, and N is the total sample size.

The international LPI is a summary indicator of logistics sector performance, combining data on six core performance components into a single aggregate measure. Some respondents did not provide information for all six components, so interpolation is used to fill in missing values. The missing values are replaced with the country mean response for each question, adjusted by the respondent's average deviation from the country mean in the answered questions.

The six core components are:

- The efficiency of customs and border management clearance, rated from "very low" (1) to "very high" (5).
- The quality of trade and transport infrastructure, rated from "very low" (1) to "very high" (5).
- The ease of arranging competitively priced shipments, rated from "very difficult" (1) to "very easy" (5).
- The competence and quality of logistics services, rated from "very low" (1) to "very high" (5).
- The ability to track and trace consignments, rated from "very low" (1) to "very high" (5).
- The frequency with which shipments reach consignees within scheduled or expected delivery times, rated from "hardly ever" (1) to "nearly always" (5).

To construct the international LPI, normalized scores for each of the six original indicators are multiplied by their component loadings (*Tab. 2*) and then summed. The component loadings represent the weight given to each original indicator in constructing the international LPI. Since the loadings are similar for all six, the international LPI is close to a simple average of the indicators.

***Tab. 2** Component loading for the international LPI*

Dimension	Weight
Customs	0.41
Infrastructure	0.41
Logistics quality and competence	0,40
Tracking and tracing	0.41
Timeliness	0.40

Source: [5]

To calculate the confidence interval, the standard error of LPI scores across all respondents is estimated for a country. The upper and lower bounds of the confidence interval are then

$$LPI \pm \frac{^{t}(0{,}1\,.\,N-1)^{s}}{\sqrt{N}} \quad (1)$$

where N..... the number of survey respondents for that country
s ..... is the estimated standard error of each country's LPI score
t..... is Student's t – distribution

The high and low scores are used to calculate upper and lower bounds on country ranks. The upper bound is the LPI rank a country would receive if its LPI score were at the upper bound of the confidence interval rather than at the center. The lower bound is the LPI rank a country would receive if its LPI score were at the lower bound of the confidence interval rather than at the center. In both cases, the scores of all other countries are kept constant.

The results of the top 10 performers of the last survey (2012) you can see in *Tab. 3*. Czech Republic is on 44 place and Slovakia is on 51 place of the LPI rank.

Tab. 3 *The top 10 performers on the 2012 LPI*

Economy	2012			2010			2007		
	LPI rank	LPI score	% of highest performance	LPI rank	LPI score	% of highest performance	LPI rank	LPI score	% of highest performance
Singapore	1	4.13	100.0	2	4.09	99.2	1	4.19	100.0
Hong Kong SAR, China	2	4.12	99.9	13	3.88	92.4	8	4.00	94.1
Finland	3	4.05	97.6	12	3.89	92.6	15	3.82	88.3
Germany	4	4.03	97.0	1	4.11	100.0	3	4.10	97.1
Netherlands	5	4.02	96.7	4	4.07	98.5	2	4.18	99.6
Denmark	6	4.02	96.6	16	3.85	91.4	13	3.86	89.6
Belgium	7	3.98	95.3	9	3.94	94.5	12	3.89	90.7
Japan	8	3.93	93.8	7	3.97	95.2	6	4.02	94.8
United States	9	3.93	93.7	15	3.86	91.7	14	3.84	89.1
United Kingdom	10	3.90	92.7	8	3.95	94.9	9	3.99	93.8

Source: [5]

4 Conclusion

The LPI provides a simple, global benchmark to measure logistics performance, filling gaps in datasets by providing systematic, cross-country comparisons. By asking freight forwarders to rate countries on key logistics issues - such as customs clearance efficiency, infrastructure quality, and the ability to track cargo - it captures a broad set of elements that

affect perceptions of the efficiency of trade logistics in practice. It is a "coarse-grained" indicator that shows where a country stands and that could motivate researchers to take on a deeper, finer, country-specific assessment of the determinants of logistics performance.

The LPI reflects the perspective of the global private sector on how countries are globally connected through their main trade gateways, so it might not fully capture changes at the country level.

Trade analysts, policymakers, and practitioners interested in measuring logistics performance all use the LPI. The World Bank and other international organizations are using it more and more in their advisory and implementation activities for trade facilitation in developing countries.

The LPI allows leaders in government, business, and civil society to better assess the competitive advantage created by good logistics and to understand the varying importance of different intervention areas.

Acknowledgement

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References

[1] http://web.worldbank.org/WBSITE/EXTERNAL/TOPICS/TRADE/0,,contentMDK:23196552~pagePK:148956~theSitePK:239071,00.

[2] http://www.sciencedirect.com/science/article/pii/S0019850197000783.

[3] Bowersox, D. J., and Closs, D. J.: Logistical Management, the Integrated Supply Chain Process. McGraw-Hill, New York, 1996.

[4] D. Bowersox, P. Daugherty, C. Droge, D. Rogers, D. Wradlow Leading Edge Logistics Competitive Positioning for the 1990's Council of Logistics Management, Oakbrook, IL (1989).

[5] Connecting to Compete 2012 Trade Logistics in the Global Economy, The International Bank for Reconstruction and Development/The World Bank 1818 H Street NW Washington, DC 20433.

[6] http://web.worldbank.org/WBSITE/EXTERNAL/TOPICS/TRADE/0,,contentMDK:23196552~pagePK:148956~theSitePK:239071,00.html.

[7] http://www.sciencedirect.com/science/article/pii/S0019850197000783.

[8] https://www.weforum.org/pdf/GETR08/Chap%201.4_Connecting%20to%20Compete.pdf.

[9] http://tfig.unece.org/contents/logistic-performance-index.htm.

[10] STOPKA, Ondrej a Ladislav BARTUŠKA. Rozbor súčasnej situácie na Slovensku z hl'adiska umestnenia a uplatnenia verejného logistického centra. In *Logi 2013: sborník příspěvků*. 1. vyd. Brno: Vysoká škola technická a ekonomická v Českých Budějovicích, 2013. s. 400-405, 6 s. ISBN 978-80-7468-059-5.

[11] STOPKA, Ondrej a Jiří KOLÁŘ. Návrh využitia inovatívnej technológie v rámci kombinovanej dopravy na území Slovenska. In *Logi 2013: sborník příspěvků*. 1. vyd. Brno: Vysoká škola technická a ekonomická v Českých Budějovicích, 2013. s. 239-247, 9 s. ISBN 978-80-7468-059-5.

[12] KAMPF, R., GAŠPARÍK, J., KUDLÁČKOVÁ, N. Application of different forms of transport in relation to the process of transport user value creation. (2012) Periodica Polytechnica Transportation Engineering 40 (2) PP. 71 - 75 , ISSN: 03037800.

[13] KAMPF, R.; CEMPÍREK, V.; KAMPF, R. Zasílatelství. Pardubice: Univerzita Pardubice, 2005. ISBN 80-7194-745-8.

[14] KAMPF, R., PRŮŠA, P., SAVAGE, C. Systematic location of the public logistic centres in Czech Republic. (2011) Transport 26 (4) PP. 425 – 432, ISSN: 16484142S.

Resume

The LPI measures logistics efficiency, now widely recognized as vital for trade and growth. A country's ability to trade globally depends on its traders' access to global freight and logistics networks. And the efficiency of a country's supply chain (in cost, time, and reliability) depends on specific features of its domestic economy (logistics performance). Better overall logistics performance and trade facilitation are strongly associated with trade expansion, export diversification, attractiveness to foreign direct investment, and economic growth.

The LPI score and country rankings for the six main component indicators come from the international part of the survey, a collection of information provided by foreign logistics professionals.

Key words

Logistics, performance, index, methodology

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LOGISTIC PROCESSES IN A COAL FIRED POWER PLANT

Dušan SOJČÁK, František BRUMERČÍK

1 Introduction

The purpose of this article is to shortly describe and provide basic information of the logistic processes in a coal power plant covering electricity demand in the described region.

2 General project description

Vung Ang 1 thermal power plant with capacity of 1,200 MWe is owned by PVN (PetroVietnam – Vietnam National Oil and Gas group).

Main fuel used by the boiler is dust coal- No.5 from Cam Pha, auxiliary fuel (for start-up and firing support in case of low load), is heavy fuel oil (FO) - No.5B in compliance with the Vietnamese standard 6239-2002. Coal and FO will be transported to the plant by sea. Coal is loaded / unloaded at the coal jetty, FO loaded/unloaded via Vung Ang Port and transported by road.

Fig. 1 *Location of VA1 coal fired power plant*

The construction location of the power plant is on the east side of Hai Phong village, Ky Loi commune, Ky Anh district, Ha Tinh province, within Vung Ang Port – industrial zone, 8 to 9 km far from the National Highway (Fig. 1) with geological coordinates: N: 18°05'-18°05', E: 106°22'-106°30'. Site elevation (to top of soil platform) is 8.00 m (MSL).

3 Configuration and logistic processes

There are 2 units each rated 600 MWe each, with common stack, coal handling, ash handling, seawater cooling system [1].

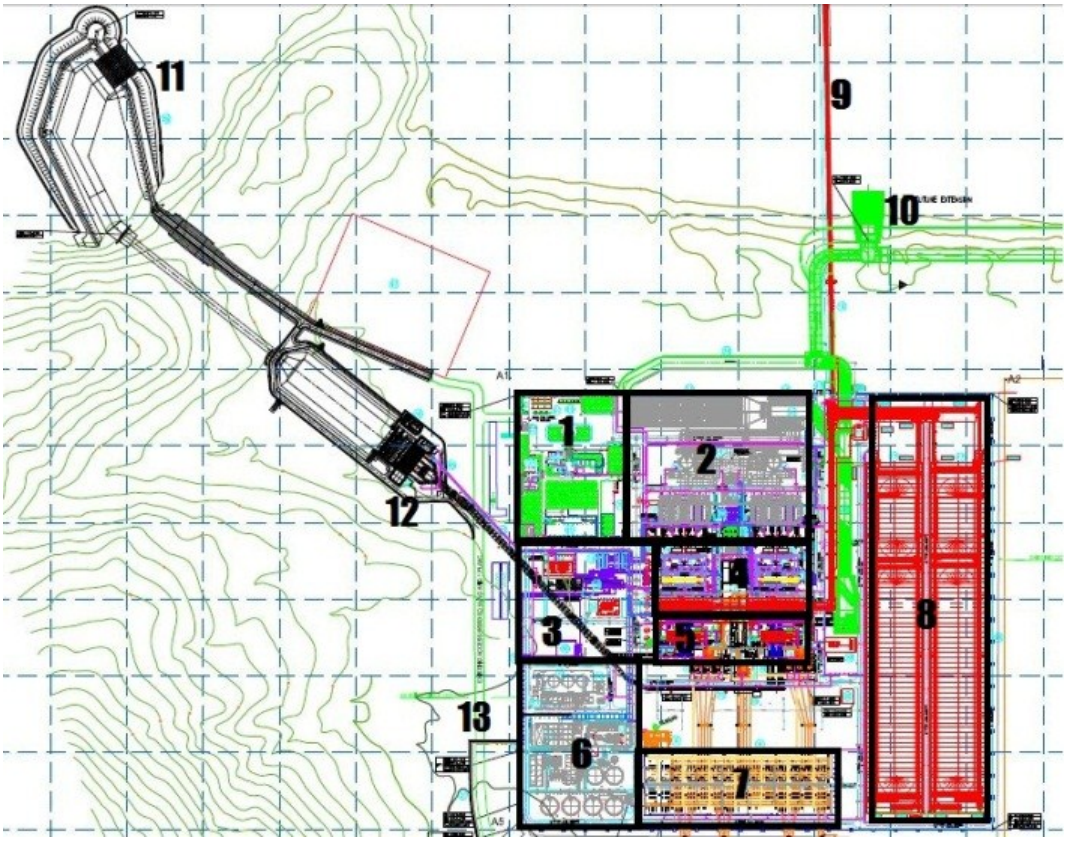
- Turbine generator gross output: 600 MWe (at MCR),
- Main steam parameters: 24,2 MPa and 566 °C,
- Main steam flow rate: 1995 $t.h^{-1}$ (at MCR),
- Reheat steam parameters: 4,263 MPa and 566 °C,
- Reheat steam flow rate: 1624 $t.h^{-1}$ (at MCR),
- Exhaust steam flow: 1151,8 $t.h^{-1}$,
- Exhaust steam pressure: (back-pressure): 10,2 kPa,
- Feedwater temperature: 280 °C,
- Stack emissions (at 6% O_2): SO_2 200 $mg.(Nm)^{-3}$
  - NO_x 400 $mg.(Nm)^{-3}$
  - CO 1000 $mg.(Nm)^{-3}$
  - Particulates 50 $mg.(Nm)^{-3}$
- Coal consumption: @ 85% capacity for both units 4200000 t per year,
- Number of ships: 40 to 50 per year,
- Cooling water (sea water) for both units: 61 $m^3.h^{-1}$,
- Generator voltage: 22 kV,
- Main step-up transformer outlet: 500 kV.

Vung Ang 1 power plant, 2x600 MWe is now in the early stages of main equipment installation. Located in the middle of Vietnam, it also plays an important role in the growing infrastructure of the area and country itself (Fig. 2).

Fig. 2 *Vietnam's 1200 MW Vung Ang 1 coal fired power plant is one of the largest infrastructure project currently under development*

Power plant layout (Fig. 3) based on basic layer of description can be described as follows [2]:

Fig. 3 *Layout of VA1 coal fired power plant*



1 – Administration, Workshop, Canteen, Warehouse buildings,

2 – Sea water Flue gas desulfurization FGD, Electro static precipitator ESP, stack,

3 – Ammonia storage system, auxiliary bolierboiler system, ash handling temporary store and system,

4 – Steam generator structure,

5 – Steam turbine structure,

6 – Heavy fuel oil system HFO, water treatment plant,

7 – Switchyard area,

8 – Coal storage area and handling system,

9 – Coal jetty,

10 – Sea water discharge,

11 – Sea water intake structure and wave block,

12 – Sea water pump house and sea water intake basin,

13 – Hydraulic ash disposal system.

Underlying the power plant design, there are the following major considerations:

• a layout to accommodate a wide range of coal, including possibility for blending two types of coals,

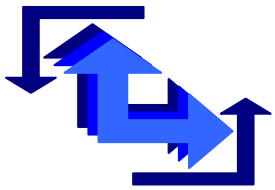
• the use of well proven components and suppliers,

• redundancy concept to avoid plant outages and minimize operation risk by supplying n+1components for all but the largest plant components.

3.1 Coal handling and heavy fuel oil storage

As the coal supply will be by ship, the plant is equipped with a coal jetty for receiving the coal, which will be unloaded by means of two continuous ship unloaders and delivered to the coal jetty yard by the receiving conveyors.

The capacity of the stock yard is about 45 days supply of coal. The two covered coal sheds are equipped with two combined stacker/reclaimers which allow simultaneous unloading from the ships with one machine and reclaiming with the other two machines for blending of two coal types. The reclaimed coal is brought via reclaiming conveyors to coal bunkers of two units.



For start-up, the plant is using light oil as fuel for auxiliary steam system, which is filled by auxiliary steam boiler. For stabilization of fire and for 30% of load the heavy fuel oil is used.

3.2 Steam generator

Each steam generator is of subcritical drum type design with single reheat. The facility is capable of operating in fixed and sliding steam pressure mode. The steam generator is two pass type, top supported with all water cooled membrane walls. The heating surface consists of three stage super heaters, single stage reheater and economiser. Superheater steam temperature control is achieved by two stage spray type desuperheaters. Reheater steam temperature control is achieved by gas dumpers, as the second pass super heater and reheater is located at in parallel flue gas paths. The economiser is located at the bottom of the second pass and consists of a horizontal tube with fins. The coal firing system is of direct, pressurised type for pulverised coal.

The coal is fed from coal bunkers via gravimetric coal feeders into the five coal mills, which are of the vertical-spindle medium-speed type. Cold and hot primary air dries the coal and transports it to the burners via pulverised coal piping. The burners are of dual flow, low NO_x type with a swirled air flow, and are arranged in opposed firing configuration. The draft system is of balance-draft type and consists of two primary air fans, forced-draft fans, regenerative air preheaters and Induced-draft fans, plus all connecting ducts up to the chimney.

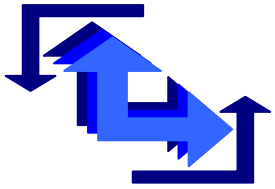
3.3 Steam turbine

The tandem-compound turbine has a single-flow High-pressure cylinder, double flow intermitted cylinders and four-flow low-pressure cylinders. Reheated steam is admitted to the intermitted section at through two combined-reheat stop and intercepts valves. The steam exhausts from the intermitted part and low-pressure part at the generator and via a crossover pipe. The low-pressure section is of two double-flow construction. It exhausts downward to the condenser.

3.4 Cooling water

Two circulating water pumps supply the condenser with circulating water from the sea. The circulating water system is unitised, with individual travelling band screens and circulating water pumps, with interconnecting discharge valves and piping. The system is equipped with cathodic protection for the purpose of corrosion protection.

After passing through the titanium condenser tubes, the circulating seawater is routed to the seal pit and later discharged into the sea. For auxiliary cooling, additional cooling water is taken from the condenser cooling water inlet to closed-loop cooling water heat exchangers. A portion of the seawater is supplied to the flue gas desulphurisation plant.



3.5 Flue gas treatment

The emission limits for Vung Ang 1 are equal to or significantly lower than World Bank guideline. The flue gas is treated in electrostatic precipitators (ESPs) and a flue gas desulphurisation plant (FGD), while the emissions limits for CO and NO are met by the advanced low NO burners.

The FGD process uses sea water's inherent ability to absorb and neutralise the sulphur dioxide of the flue gas. The flu gas is routed to the absorber where flue gas and seawater are brought into contact with a counter current flow. After reaction with the seawater, the desulfurized clean flue gas exhaust is emitted to the atmosphere via the stack. The seawater used in the FGD will be treated before it is discharged, first in a mixing chamber-process where acidic absorber effluent and additional seawater are mixed to neutralise the pH and then in an aeration basin process where oxidation of $S0_2$ to sulphate, pH neutralisation on and oxygen saturation of the liquid are carried out.

3.6 Ash handling

The ash-handling system consists of submerged scraper conveyors (SSCs), which are used to remove ash from the boiler bottom hopper and transport it via crushers to the bottom-ash silo. From this silo the ash will be transported by ash slurry systems with a recirculating- water system to the ash pond. The fly-ash handling system carries fly ash pneumatically from the other boiler hoppers and the ESP to the fly-ash silo. From the fly-ash silo, the fly-ash will be loaded into dump trucks for reuse or brought to the ash pond.

3.7 Water and waste water

An ion exchange system provides the demineralised water for power plant operations.

The waste water treatment plant is designed to treat all effluents produced from the plant to comply with the environmental regulations.

3.8 Instrumentation and control

The human/machine interface will be centralised in the central control room (CCR) to provide the overall plant control, monitoring, alarm and event functions [1]. The operator will be able to control and monitor all plant equipment except for the coal handling system, which has a separate control room. A distributed control system will be used for the main plant control while PLCs will be used for the balance of plant control such as water treatment, main cooling water, etc. An interface will be provided between DCS and PLC to enable the operator in the CCR to monitor the whole plant process areas. The control systems are designed on a hierarchical basis: unit, group, sub-group and drive level.

3.9 Electrical systems

Each generator which is equipped with static isolation system, is completely enclosed and uses hydrogen as the cooling medium for the rotor section [2]. The stator winding is

directly cooled by demineralised water. Power from each generator is fed through the generator transformer to a 500/275 kV substation. The facility will be connected to the national grid system via a 500 kV transmission line.

Part of the output from each generator provides the auxiliary power supply to the power plant through the unit auxiliary transformer, for internal consumption. Each unit has an interconnection to the common facilities supply. These connections can also be used to start one unit from another without having to draw power from the public grid.

4 Conclusion

As described in the article, the power plant layout consists of many systems to meet electricity power generation and environmental requirements. Generally, it can be concluded that such a plant involves main equipment steam generator, steam turbine, fuel handling, main cooling system and balance of plant that is supporting the main equipment creating required power ration and meet performance guaranties.

References

[1] SULAIMAN, A., JOHNSEN, M.: *Making of Tanjung Bin – Project Development of a Coal-Fired IPP*. HAPUA Generation Forum 2007, Kuala Lumpur, January 2007.

[2] JOHNSEN, M: Tanjung Bin Underway - Malaysia's 2100 MW Tanjung Bin Coal-fired Plant is one of the Largest Infrastructure Projects Currently under Development in South-east Asia. *Modern Power Systems*, January, 2004.

[3] BUKOVÁ, B. a kol.: *Zasielateľstvo a logistické činnosti*. Bratislava. Iura Edition. 2008.

Resume

The article describes basic logistic systems and processes in a coal fired power plant and brings a view of energy source concept in later mentioned production of electricity rate. The article includes the steam generator, steam turbine, fuel handling, water treatment and also ash disposal system short description.

Key words

Coal, power plant, performance, logistic, process

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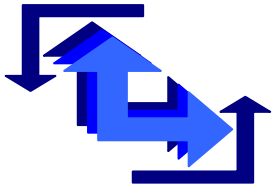

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THE EVALUATION OF INFRASTRUCTURAL PROJECTS FOCUSED ON QUALITY INCREASING IN PUBLIC PERSONAL TRANSPORTATION

Eva KICOVÁ, Ladislav JARINA

Introduction

In current period there is no doubt upon great importance of transport infrastructure in transport operation area. It has fundamental influence on economic growth, mobility of labor and competitiveness within international division of transport labor. Besides it has great impact on quality public transport, in addition to that improves the environment. The transport infrastructure is one of the key factors, which also significantly influence economic development and state spatial organization. Definitely it has fundamental importance also for development of border regions in all its indicators.

1 Infrastructure state in SVK and Czech as condition of foreign capital input

As the quality infrastructure is considered as condition on foreign capital input, it is necessary to pay appropriate attention to sphere of transport corridors building in country. Following tables present current state of railway and road infrastructure in SVK.

Tab. 2 *Railway infrastructure SVK up to 10/2013*

Indicator	**2008**	**2009**	**2010**	**2011**	**2012**
The lenght of railway	3 623	3 623	3 622	3 624	3 631
The lenght of electrified line	1 577	1 577	1 578	1 578	1 586

Source: [4]

European union transport policy defines railway as also called green transport, so the most environmental way of transport. Building and modernization of railway corridors in ŽSR network and other infrastructure is together financially the most demanding. Fig. 1 presents the length of railway in region of Slovakia. In sphere of railway transport is operated by lines in length of 3631 km, from which is approximately 50 % electrified.

Following fig. for a change presents current state of motorway network in full or limited operation, the building state and the plan of building in Slovakia for following years.

Tab. 2 *State highway network to 01/2014*

	D1	D2	D3	D4	Motorways total (km)
in operation	312,039	80,05	8,68	2,00	402,77
½ profile	8,06	0	4,30	3,025	15,385
in building	72,77	0	0	0	72,77
½ profile	0,76	0	15,26	0	16,02
in preparation	123,55	0	31,61	42,90	198,06
½ profile	7,30	0	19,56	3,025	29,885
The length of the route	516,42	80,051	59,85	47,925	704,246

Source: [5]

The whole infrastructure in Slovakia is currently characterized relatively heavy road network, where the part of higher class roads (motorways and speed ways) while does not cover whole country area. According to this the problem arise mostly on main international road connections, where comes to exceeding of existing road.

Range of motorway network and network of speedways in Slovakia defined by motorway routes D1, D2, D3 a D4 in total length of 705 km and the range of speedways network by routes R1, R2, R3, R4, R5, R6 and in the prospect are planned speedways tract R7 and R8, in total length of 1 175 km.

Tab. 3 *State speed ways to 01/2014*

	R1	R2	R3	R4	R5	R6	R7	R8	Speed ways Total in km	
									with peaz	without peaz
in operation	170,03	0	0	0	0	0	0	0	247,8	188,8
½ profile	0	18,17	17,48	4,57	0	2,68	0	0		
in building	0	22,50	1,65	14,20	0	0	0	0	67,2	67,2
½ profile	0	4,40	0	0	0	0	0	0		
in preparation	92,24	268,34	167,85	80,78	1,98	23,00	218,91	54,89	948,1	919,3
½ profile	0	22,57	17,48	4,57	0	2,68	0	0		
The length of route	262,26	314,41	186,98	99,53	1,98	25,68	218,91	54,89	1263,1	1175,3

Source: [6]

Within the North Slovakia, the city Žilina presents significant transport junction, where meet three routes of international importance. Fundamental importance has connection with Poland on route European transport corridor num. VI. and Czech directed to Ostrava.

From Žilina district is connection with Poland on route of European corridor num. VI., which exits from Žilina directed to the North through Čadca and Skalité to Poland (route D 3), where continues the route speedway S 69 through Bielsko-Biala directed to the North and connects to motorway 4 south-east from Katowice. Another very important connection presents direction to Czech Republic, where currently exists intensive cooperation in car manufacture.

Particularly after the establishment of automobile factory KIA Motors Slovakia nearby Žilina and Hyundai in Moravské Nošovice, but also after establishment of adjoining industrial zones is today route infrastructure excessively heavy.

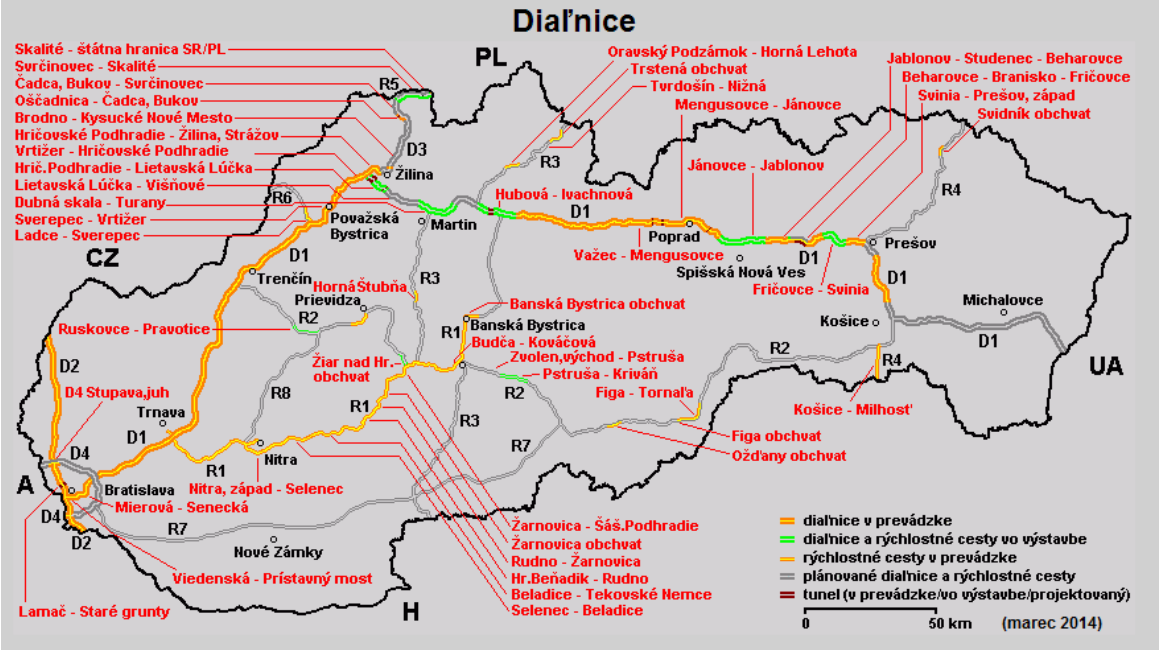
Completion of motorway tracts and speed ways mostly among these regions will have main importance for reducing heavy traffic, positive influence for wide business activities, sphere of tourism, can together also have positive influence on environment in both regions. Temporary alternative can be using of railway connection between both automobile factories. The problem can appear in time provision of goods delivery by railway comparing to usage of route infrastructure.

According to these and other factors can be current state of route network evaluated as not sufficient. There are missing connections of motorway tracks and speed ways to make up compact tracks connecting main centers, which would be together connected to route network of neighboring countries, mostly from the North to South. We can assume that the compact network of motorways and main speed ways would be finished after 2020.

As a final consequence will the economic growth of country play important factor. I tis necessary to say that insufficient developed transport network has partially negative impact on economic country activity.

The impact of developed transport route on region development can be seen also on regional level. It can be seen mostly in region of West Slovakia, where is main part of motorway network built up. And exactly these regions show better economic indicators in sphere of foreign capital input, lower unemployment, higher average month salary and the like. Following picture shows motorway network of SVK.

Fig. 1 *Motorway network in SVK*



Source: [7]

There are similar problems also in other transformation countries. Comparing to Czechs, in statement of country range, Czech republic doesn´t show strong being ahead within motorway network. But the difference is in its layout within whole area and connection to neighboring countries. The motorway network of Czech rep. is shown in following picture. This can be definite positive element for foreign investors at providing transport and logistic centers layout.

***Fig. 2** Motorway network CZ*

Source: [8]

As on one side the economic growth is connected to quality infrastructure , which is still missing in most parts of region and on the other side important part plays limited possibilities of state budget, it is necessary to think about application of methods optimize expenses of infrastructure, so to minimize society-wide costs.

One of these methods, which we can use within SVK, is the analysis of costs and contribution used by the World bank for evaluation of all uncritical route projects.

2 Evaluation system of transport projects

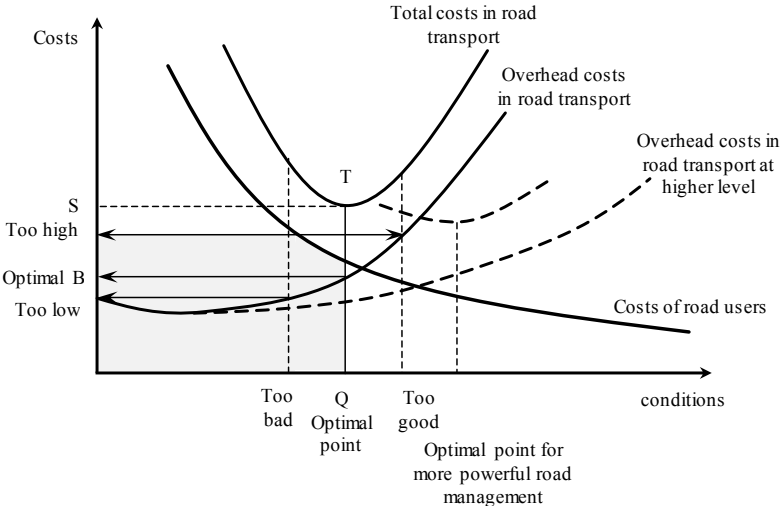
Acceptable standard for route projects evaluation became at the end of 60ś analysis of costs and contribution, so called CBA analysis. Very important elements in evaluation projects are design elements and geographic location apparatus, which influence time travelling and costs, road security, environment and costs for transport. Very important are also factors which are relevant and which are not included in CBA analysis. These include price list and the payment method for service, financing, regulation, organization and management of road sector institutions. All these factors have impact on costs and contributions.

The road system is through this analysis proposed and built up on functional and technical standards, which minimize total road costs of company. In the course of total

company costs in road transport shows pic. 3. These costs consist of these following mutually influencing complex of costs:

- construction costs,
- costs for renovation and maintenance,
- costs for common maintenance,
- haulier costs, mostly costs for vehicle operation, costs incurred as consequence of accidents and downtime etc.,
- External costs, as environment pollution.

Fig. 3 *Total costs in road transport*



It is evident from fig. 3, that with better road conditions the curve presenting costs of road users is decreasing and the curve of overhead costs in road transport is increasing. The curve of total road costs, which is some of these two cost has minimal value, so called optimal point, in point „Q“. Total costs for its reaching and keeping presents „S“ point, where overhead costs in road transport are OB and costs of road users are BS. Minimized total transport cost T presents summation B+S. Fig. 3 in the same time provide the best road standard and its affiliated overhead cost, or road overhead budget for given region or network and its optimal level.

Effective road management requires longterm road program composed from different elements, which connect to condition of road, for example worn-down, bumpiness etc. These parameters influence costs of road users are depended on activities of road management (reconstruction, the surface of road) and their costs for reaching specific road condition. These elements move from common year maintenance up to road renovation. Just for better illustration we state example. It stands, that common costs are lower than costs for road renovation. Let’s suppose that the road condition will get worse and that’s why the road can not be returned to original condition only by common service. Also the costs of road users on this road will be much higher than on the road which needs only common service. These costs usually occur in various years and must be based on comparable level.

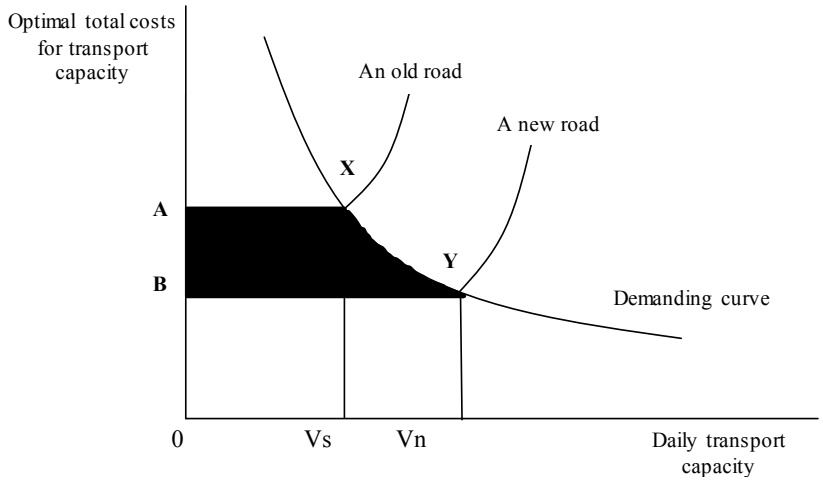
From this reason we have to take into consideration current and future costs, i.e. plan of costs, which must be optimalized. Analytic procedure for realization of this concept due to this reason must be able to take into account current and future costs.

But the idea presented in graph hides common reality of road management. People charged with decision often meet with financial limits and have to face budget limit or road standard limits. If we want to focus on this reality, it is important that analytic procedure enables to managers find the second best solution in light of these limits. The graph in fig. 3 can be used for simple illustration of reality, what effect have standard and budget limits for dividing and distribution of money, which lead to too good or too bad road condition. The dotted line in fig. 3 shows, that the more efficient road management can provide for road users more quality service for lower prices.

The base of CBA analysis is demanding curve, which shows consumer willingness, in this case user of road transport, to pay for provided capacity of executive various prices. The relationship between executive capacity and price for given executive is shown in fig. 4.

According to consumer theory demanding curve doesn´t show only amount of goods and service bought for certain prices, but also their ceiling utility value. The space under demanding curve, which is in fig. 4 marked as ABXY represents advantages for customers even if we compare it to expenses, it represents investment. The most used criterion in transport projects for CBA analysis is net profit.

Fig. 4 *Demanding curve*



3 Conclusion

The method CBA projects and programs is focused on development and building of transport infrastructure of country inevitable for economic country growth and in final consequence also for quality increasing of public transport. It is one of the key factors which influence economic development and spatial state layout. The transport infrastructure of country has fundamental importance for development of border regions in all his indicators.

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References

[1] Faith P.: Význam cestnej infraštruktúry pri rozvoji kontaktov v regióne žilinského kraja a sliezskeho vojvodstva 1, In.: Zborník príspevkov z medzinárodnej vedeckej konferencie „Ekonomicko-sociálne aspekty cezhraničnej spolupráce v regióne žilinského kraja a sliezskeho vojvodstva 1, Žilina: MIDA PRINT, 2012. - ISBN 978-80-971018-1-7. -str. 33-39.

[2] Materiály VEGA 1/0477/03 Metodika finančnej kvantifikácie prínosov. bezpečnostia enviromentálnych účinkov v hodnotení projektov DI.

[3] Štatistická ročenka SR 2010, vydavateľstvo SAV, vydal ŠÚ SR, Bratislava 2010.

[4] http://portal.statistics.sk/showdoc.do?docid=23751.

[5] http://www.ndsas.sk/dialnice-d/44379s.

[6] http://www.ndsas.sk/rychlostne-cesty-r/44380s.

[7] http://dialnice.szm.com/highways/highways.html.

[8] http://www.ceskedalnice.cz/image/mapa-velka.gif.

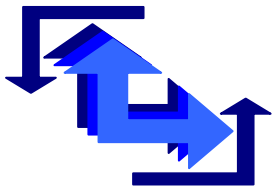
[9] www.telecom.gov.sk.

[10] http://www.ceskedalnice.cz/image/mapa-velka.gif.

[11] http://dialnice.szm.com/highways/highways.html.

Resume

The contribution approaches economic methods of infrastructure projects evaluation, necessary for economic growth of country, region development or foreign capital input. Together they contribute to quality increasing of public transportation and by that also to environment protection.



Key words

Transport infrastructure, region development, cost contribution method, security, environment

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LOGISTICS OF THE DISPOSAL OF MUNICIPAL WASTE

Jiří MÍKA, Monika KUČERKOVÁ

1 Introduction

The large and difficult solvable item of the waste is the municipal waste, it means the waste which is produced by ordinary citizens, plus that which is added from the operation of restaurants, shops, etc. Production of municipal waste in Czech Republic was indicated about 4,5 mil. tons in a year. In the latest years it is in the frame of information system ISOH indicated gradual decline and in 2006 this value was about 4,1 mil. tons, it means approximately 401 kg per person in a year. Share of production of municipal waste on the total production of waste in Czech Republic nowadays represents 14 %.

2 Informational pages of the research project SP/2f1/132/08 „The research of features of municipal waste and optimization of their use“

Table 1 - Almost 75 % of the municipal waste weight was disposed by landfill in 2006. The use of municipal waste represented 20 % in 2006. Approximately 11 % was used materially, energetically 9 %.

Tab. 1 *Development of the production of municipal waste in Czech Republic in 1998-2005*

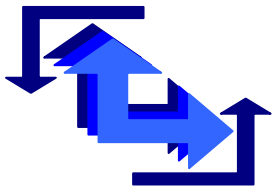
Thousand t/year	1998	1999	2000	2001	2002	2003	2004	2005	2006
Waste totally	41327	37223	40610	38694	37968	36087	38750	29802	
Municipal waste	4535	4304	4258	4243	4615	4446	4652	4276	4121

Source: VÚV – CeHO

Solution of problems of the municipal waste is possible by three ways:

- Sorting and recycling of waste with the aim to return the material back into circulation
- Combustion with the use of energetically potential
- Permanent storage of the waste on dumps – landfill

Current situation shows that most of the municipal waste will end on the landfill. At the first sight it is the easiest solution, but the controlled landfill is a very expensive construction because it must ensure the surroundings against negative influence of the waste



and it's not always successful. Moreover it's necessary to identify suitable locality with suitable substratum, so its location in terms of carrying area doesn´t have to be optimal. Moreover the landfill withstands for several years and after it's filling the new process of building the new landfill starts and the plan of transport must be revised. After closing the landfill of the municipal waste the mineralization process runs inside implemented by the development of flammable gas (landfill gas) which must be taken away and burnt in an appropriate manner for 30 years. Dumps represent a huge volume and long-term environmental burden.

The disadvantages of the dumps are that they occupy a large area, smell and drift of light waste components (especially paper and plastics), threat to surface and groundwater, reproduction of animal parasites (rodents and birds) who can cause the release of toxic and infectious substances into the environment and the danger of the dump fire. For example the fire of the dump in Líšov in the region of České Budějovice was disposed by the units of professional and voluntary firefighters from Saturday 16 September 2006 afternoon 4pm until Wednesday 20 September 2006. The intervention requested the deployment of nine fire brigade units, due to the need of deployment of the heavy sapper technology also the 153th rescue battalion of The Army of Czech Republic Jindřichův Hradec was called to action. The intervention was obstructed especially by uncontrollable fire spread inside the dump body.

The opposite counterpart is the separated collection and the consequent recycling of usable parts of the municipal waste with the use of its secondary raw material. All known colored containers are designed to store the plastics, glass and paper. This method is undeniably the best but it has its limits. The waste collected in this way comes into the production as the secondary material and it is not usable for every technology and for the achievement of specific production only the part of the secondary material can be possibly used. There is also the danger in poor awareness and indiscipline behavior of inhabitants.

For instance a lot of people have apparently fixed the name of the shops Glass-porcelain and they are willing to add the porcelain or stone product into the separated glass. It is quite the same for the glassworks if the porcelain product occurs among the glass due to negligence or poor awareness. The damage of technology will be serious and expensive. This is one of the reasons why only the part of recyclable waste gets into the separated waste and the rest ends together with non-recyclable components in so called residual municipal waste which must be disposed in some way. Also the part of recyclable components which is polluted while using will get into the residual waste. Currently, as we have said before, the majority of so called residual waste ends in the landfill. This mixture contains both inert and flammable components. The average heat value of municipal waste moves approximately 10 MJ/kg, it means that it has the heat value of brown coal and

directly there is the offer of its use as the fuel for the production of the heat and electrical energy. This fuel is so far buried at great cost under the ground and to ensure the supply of heat and electrical energy the coal is mined. This coal could be used in another way, alternatively saved for next generations.

3 Incineration of waste

By incineration of waste its chemical heat is used and also the biological components, it means the direct source of threat is disposed. Moreover their amount is reduced. The waste contains approximately 30 % of ash which is divided into cinder, ash and so called filter cake, it means harmful substances entrapped while flue gas clearing. These ashes represent approximately 10 % of all volume. In case these ashes need to be landfilled, they would take only 10 % compared with the original waste and their landfilling would pose fewer problems than landfilling the original waste. One part of cinder and ash could be used in construction and only the filter cake would be needed to dispose as the dangerous waste. This part contains mostly heavy metals and could be dangerous for the environment. On the other side we can suppose that it will be possible used as the source of heavy metals in future.

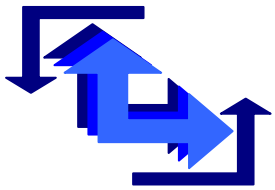
Separately harvested usable components represent almost 53 kg per inhabitant a year (it means approximately 13 % - *Table 2*) (http://www.komunalniodpad.eu.)

Tab. 2 *Development of ways of treatment with municipal waste in CR*

% weight	Use	Material use	Energy use	Disposed by landfilling	Disposed by combustion
Year 2002	14	12	2	63	7
Year 2003	16	11	5	63	5
Year 2004	21	12	9	64	0
Year 2005	21	12	9	68	0
Year 2006	20	11	9	75	0

Source: VÚV – CeHO

Separated collection has one more aspect which can be forgotten. Originally relatively simple disposal of mixed goods is divided into the collection of residual waste and the disposal of several other components. At the first sight nothing is changed. Total amount remains the same and also the number of disposed tons will be the same. There occurs one factor, it is the price of purchasing waste. It of course moves according to the demand and in the moment when the purchasing price of certain component increases we are the witnesses of diligence of people who earn from selling the waste. Their effort focuses on containers and separated component disappears. Of course, it will go to the same place but the properly



assembled model of disposal is brought to nothing. Moreover it is not possible to change it because not all containers were chosen and so the wagons return used only partially.

4 Transport of municipal waste

Transport of municipal waste is a very complicated matter. It represents the transport of considerable volume and therefore it is popularly used by opponents of incinerators because it significantly increases the congestion in the incineration site. Try to compare the current status when approximately 75 % is transported to the landfill and the status when this amount will be transported to the incinerator. At the first sight nothing is changed only this amount is directed to another place.

However there are two more aspects. The landfill usually lasts several years, later it is full and it is necessary to reshuffle all the process and direct the disposal to the new site. And the landfill cannot be built wherever and therefore we can suppose that the distance will increase. Besides the transport model developed for the landfill is usable only for the time of its service and several years later it is necessary to be revised. On the other side the incinerator can be built nearer to the source and it lasts much longer and in the moment of its finishing it is possible to remove the old equipment and build the new one in the same place.

Of course the incinerator will produce ashes and the opponents of incinerators usually object that the waste is reduced “only” on one third. To be accurate the reduction is not one third (33, 3%) but on 30%. Of course these percents are weight and in terms of the size of waste dump the volume is more important and in this case the reduction is indicated not on 30% but on 10%. Moreover the part of ashes can be used in the construction so less than 10% goes to the final landfill and then in this phase the decrease of transported volumes occurs. The imposition and necessary precautions for the landfill operations are also simplified because there is no danger of overgrowth of parasitic animals and also the danger of the drift of material and there is not the risk of burning.

5 Conclusion

Summarizing the comparison of landfill and combustion of waste in terms of transport, combustion represents minimally simplifying the organization of transport and in most cases also shortening of traffic routes both by permanent location of target station (incinerator) and significant reduction of transported amount of waste towards the site of final disposal.

References

[1] Informational pages of the research project SP/2f1/132/08 „The research of features of municipal waste and optimization of their use“. Available from: <http://www.isvav.cz/projectDetail.do?rowId=SP%2F2F1%2F132%2F08>.

[2] VÚV – CeHO. Web page. © 2009–2014 VÚV TGM, v.v.i. – CeHO. Available from: <http://www.ceho.cz/>.

[3] http://www.komunalniodpad.eu.

Resume

The aim of this article is to compare the methods of the disposal of the municipal waste, it means separated collection, permanent disposal on a landfill and its energy use (combustion) first of all from the view of the movement of material and problems with its ensure. Separated collection represents separated containers and separated removal of several sorted kinds of waste. During the storage it is necessary to ensure the transport of the total amount of waste to landfill and its usability is finite mostly by several years and after their filling its necessary to rebuild all scheme to the new locality, mostly more distant from the source. During the combustion the route and distance are unchanged for a long time and during the volume reduction of waste on approximately 10 % represents the transport of solid residues after the combustion only the fraction of its initial quantity.

Key words

Waste, municipal waste, combustion, landfill, transport, distance, energy use, saving of fossil fuels

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