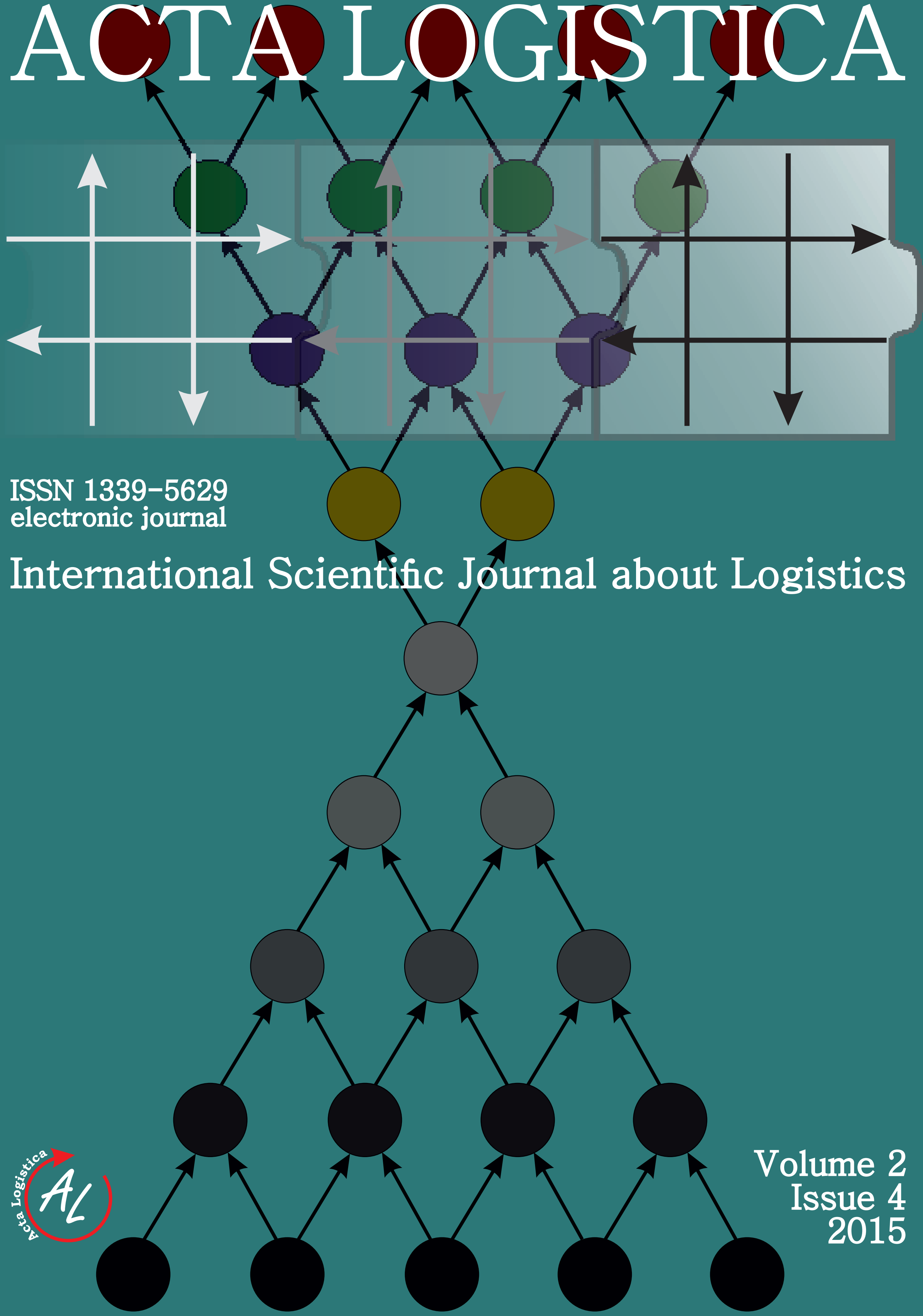
ACTA LOGISTICA



ISSN 1339-5629
electronic journal

International Scientific Journal about Logistics

Volume 2
Issue 4
2015

CONTENTS

(DECEMBER 2015)

Acta Logistica - International Scientific Journal about Logistics
Volume: 2 2015 Issue: 4 Pages: 1-6 ISSN 1339-5629

MONTE CARLO METHOD AND APPLICATION IN @RISK SIMULATION SYSTEM

Gabriela Ižaríková
TU of Košice, Faculty of Mechanical Engineering, Institute of Special Technical Sciences, Department of Applied Mathematics and Informatics, Letná 9, 042 00 Košice, e-mail: gabriela.izarikova@tuke.sk
Peter Trebuňa
TU of Košice, Faculty of Mechanical Engineering, Institute of Technology and Management, Department of Industrial Engineering and Management, Nemcovej 32 , 042 00 Košice, e-mail: peter.trebuna@tuke.sk

Keywords: simulation model, Monte Carlo method, simulation system, design

Abstract: The article is an example of using the software simulation @Risk designed for simulation in Microsoft Excel spread sheet, demonstrated the possibility of its usage in order to show a universal method of solving problems. The simulation is experimenting with computer models based on the real production process in order to optimize the production processes or the system. The simulation model allows performing a number of experiments, analysing them, evaluating, optimizing and afterwards applying the results to the real system. A simulation model in general is presenting modelling system by using mathematical formulations and logical relations. In the model is possible to distinguish controlled inputs (for instance investment costs) and random outputs (for instance demand), which are by using a model transformed into outputs (for instance mean value of profit). In case of a simulation experiment at the beginning are chosen controlled inputs and random (stochastic) outputs are generated randomly. Simulations belong into quantitative tools, which can be used as a support for a decision making.

1 Introduction

A simulation model in general is presenting modelling system by using mathematical formulations and logical relations. In the model is possible to distinguish controlled inputs (for instance investment costs) and random outputs (for instance demand), which are by using a model transformed into outputs (for instance mean value of profit). In case of a simulation experiment at the beginning are chosen controlled inputs and random (stochastic) outputs are generated randomly [1]. Simulations belong into quantitative tools, which can be used as a support for a decision making. Their application in practice cannot be done without computer support and specialized software products [2]. For simulations is possible to use a basic tabular processor as for example Microsoft Excel [3]. In the following part is used simulation software Risk, suitable mainly for simulations in the tabular processor Microsoft Excel.

@RISK performs risk analysis using Monte Carlo simulation to show how many possible outcomes in a spread sheet model exist and tells how the likelihood they might occur is. It mathematically and objectively tracks many different possible future scenarios and assess the probabilities and risks associated with each different one. This means that it gives an assessment which risks to take and which ones to avoid, allowing for the best decision making under uncertainty [4].

2 Monte Carlo method

Monte Carlo method is a simulation numeric method, which can provide at least probabilistic results in case those classical calculations are too complex, too long or even not possible to compute. It is a stochastic method, because when searching for a result is used probabilistic number of modelled random variables statistical estimates of their characteristics [5].

The method is based on multiple irritation of random process. Realization of probabilistic variables can be achieved by generating of random numbers, uniformly distributed on interval (0, 1), which are subsequently by suitable transformation transformed into random numbers with desirables distribution. Random numbers are possible to generate by several ways: mechanic generators, physical generators. It is possible to distinguish random and pseudorandom numbers. By using of Monte Carlo method are estimated statistic distribution based on a huge number of random choices from given distribution [5]. Simulation is resource for increase quality, innovation and prosperity [6], [7]. This system, method will used in @Risk simulation system [8].

2.1 Application add-on @RISK

After running program @Risk and Microsoft Excel in the top menu of Excel is shown option depicted in the Fig. 1.

Random inputs of model are generated by using add-on @Risk in the top menu in folder “Define Distribution”, in option for discrete and continues probability distribution– Fig. 3. and Fig. 4.

For example it can be defined normal distribution with a mean value 10 and standard deviation 2 N≈(10,2). It is possible to click on the icon "Normal" (Fig. 2) window appears (Fig. 3) In the middle is a graphical representation of normal distribution, on the left can be added mean value and standard deviation and on the right are depicted descriptive statistics. The second possibility is generating of random inputs is to write function directly into a cell – for normal distribution it is "RiskNormal (mean value, standard deviation)".

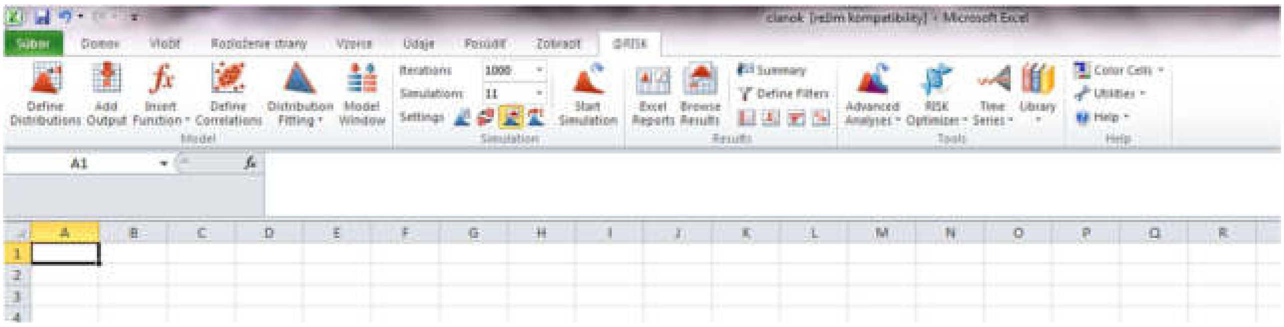


Figure 1 Toolbar – menu for add-on @Risk

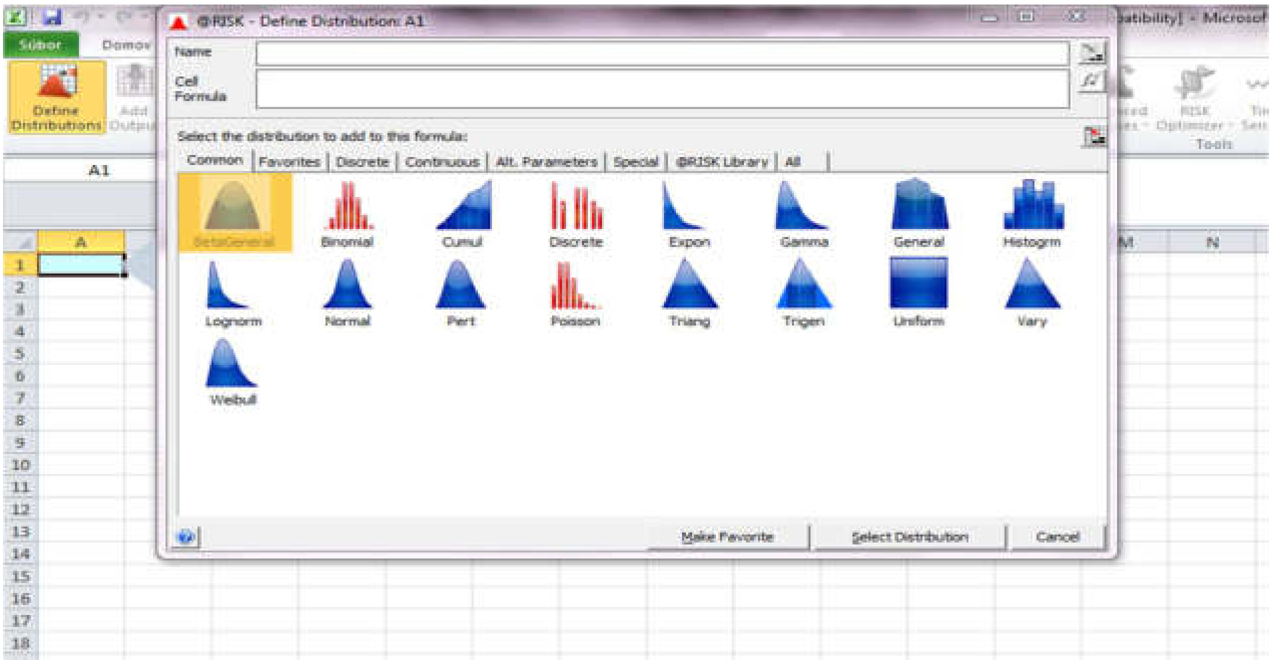


Figure 2 @Risk simulation system and definition of distribution function

Acta Logistica - International Scientific Journal about Logistics
Volume: 2 2015 Issue: 4 Pages: 1-6 ISSN 1339-5629

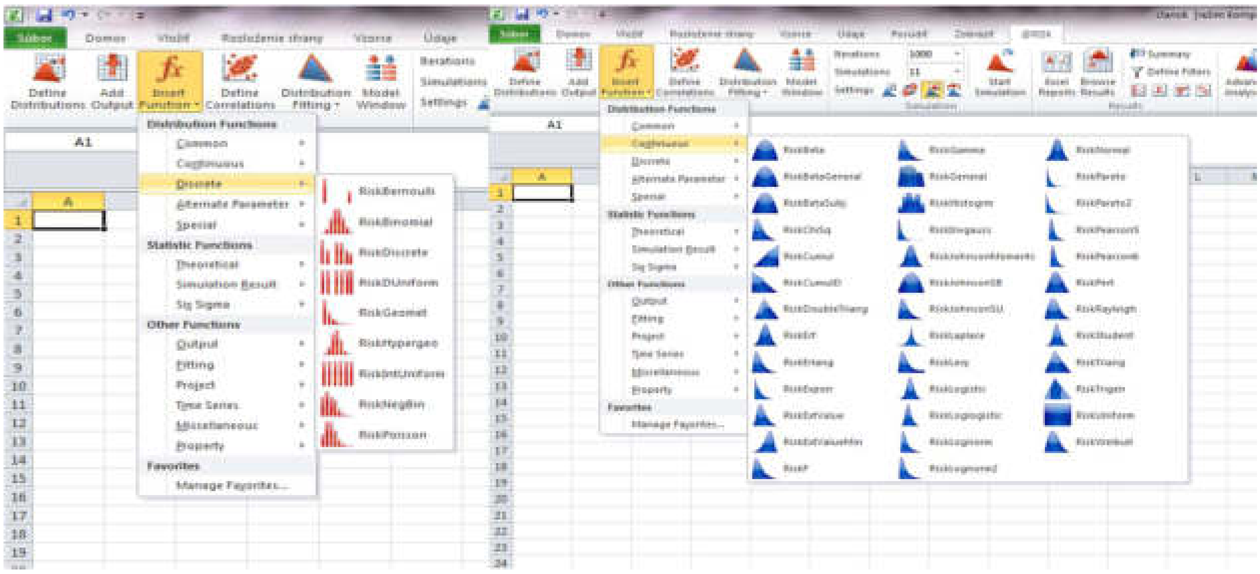


Figure 3 @Risk simulation system, option probability distribution

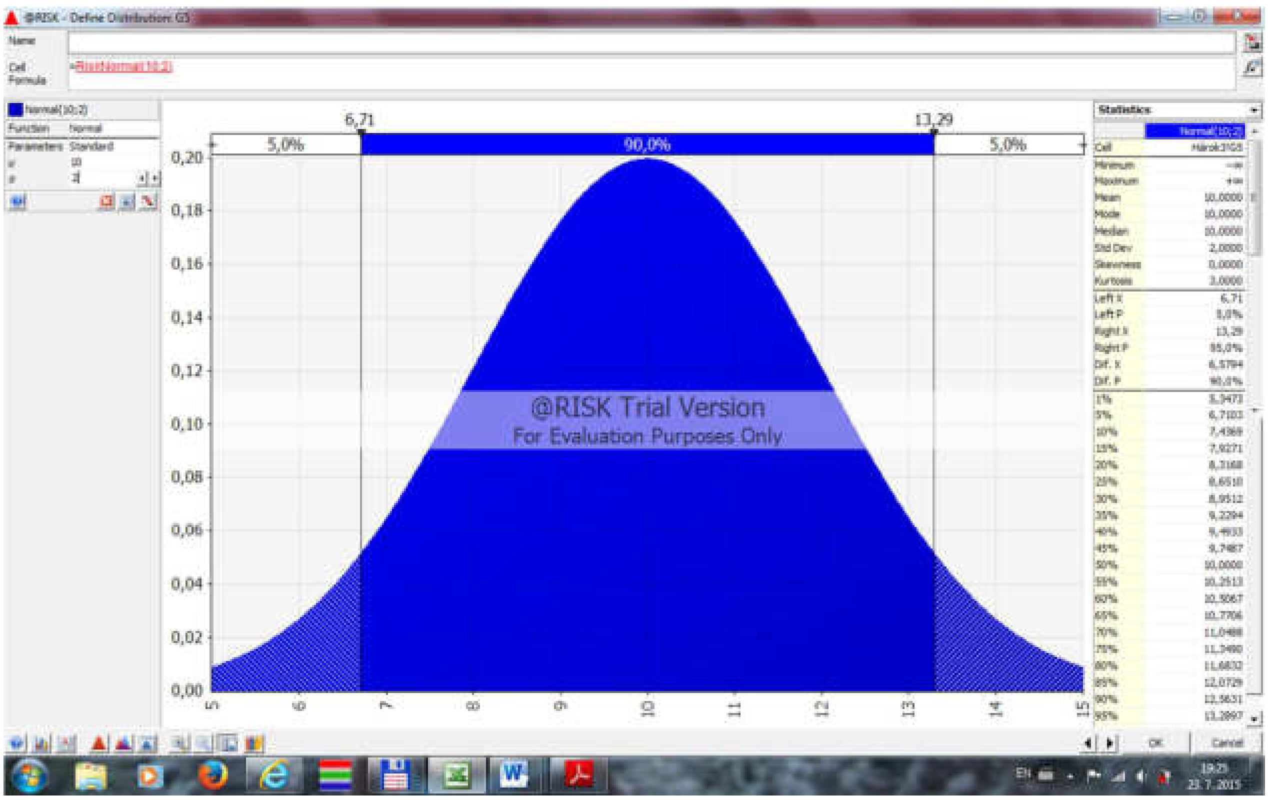


Figure 4 @Risk simulation system, definition of normal distribution

Design of simulation model by using of add-on @Risk :

- Define probabilistic distribution for a random inputs, it means generating of observations of a random inputs (for example by using function @Risk).
- In a simulation model is chosen a cell representing output of model (output cell). Add-

Volume: 2 2015 Issue: 4 Pages: 1-6 ISSN 1339-5629

on @Risk calculates automatically descriptive statistics for output model and generate also their graphical representation.

- For different values of variables is possible by using function „RiskSimTable" run the simulation several times and subsequently compare results and choose the best value of crucial variables.

In the next section is represented construction of simulation model on a concrete example: at the beginning of a month is necessary to add inventory of given product, which purchasing price is 3 eur/piece and selling price 5 eur/piece, in case that this product is not sold until 20th day of the month is sold in discount for 2 eur/piece. Demand for this product is random with discrete distribution in Table 1. The task is to construct a simulation model based on the given order.

Construction of simulation model:

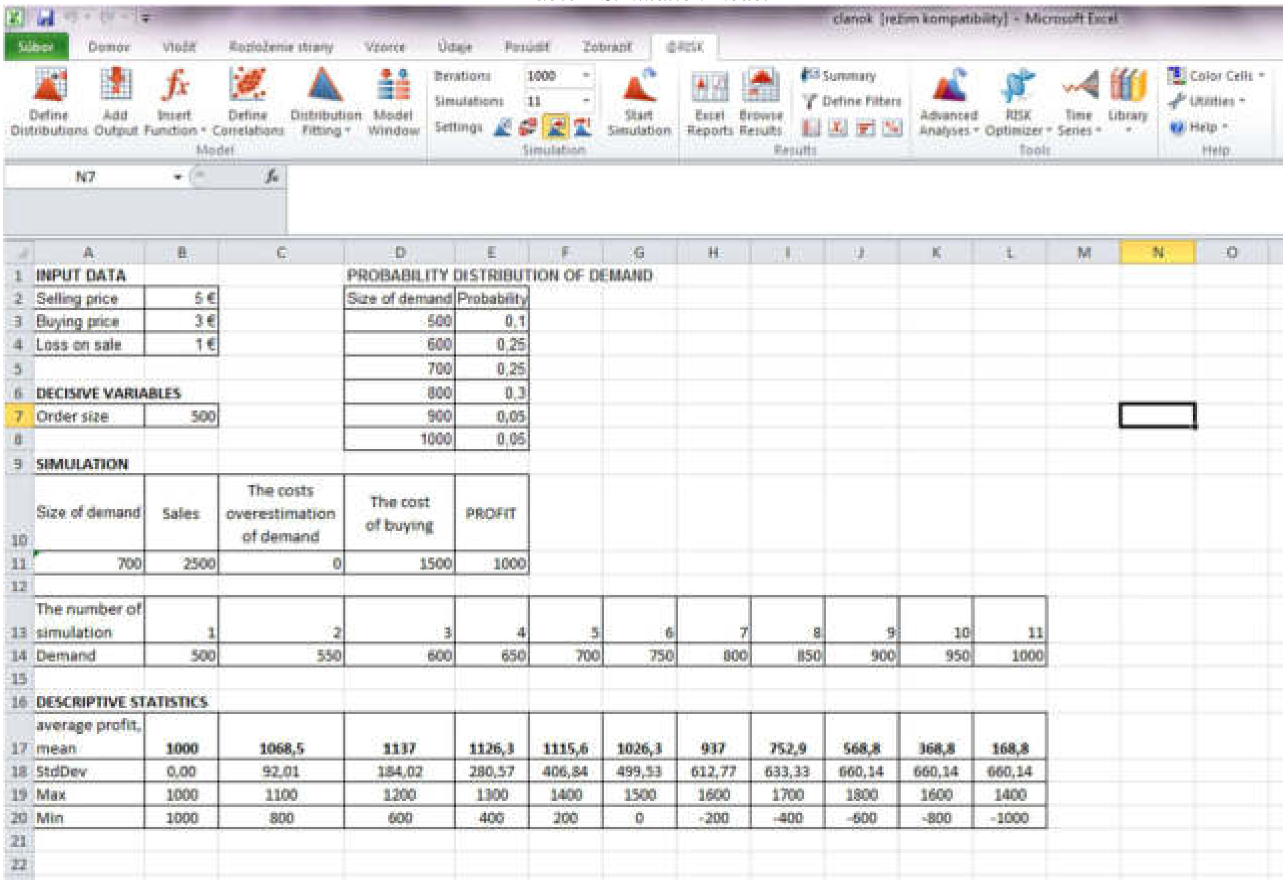
A random input means demand, which is given by discrete probability distribution. In Table 1, in cell A11 is defined by function - „=RiskDiscrete(D3:D7;E3:E7)". Output of the model, which is a profit (lost) in cell E11 and is given by relation „=B11-C11-D11" (profit = sales- costs overestimation - cost of buying). This formula can be changed with add-on, by setting on cell E11, in the top menu click on the option "AddOutput", validate it with the fuction in the cell E11 and change on "RiskOutput()+B11-C11-D11".

In the next step is set setting (number of irritation for example on 100) simulation and run simulation. By using @Risk function "RiskSimTable" it is possible to compare descriptive statistics for different values cotrolled inputs into model, „=RiskSimTable(B14:L14)".

The function RiskSimTable makes possible to run several simulations for different values of controlled inputs, in this case 11 times evaluate thousand values of profit (lost). In this section B14:L14 are shown different values of controlled input according to amount of order. Number of irritation 1000 and number of simulation 11 is set on top menu @Risk.

Function for a calculation of descriptive statistics are inserted thought top menu @Risk – Insert Function – Simulation Result - RiskMean, RiskStdDev, RiskMax,

Table 1 Simulation model



	A	B	C	D	E	F	G	H	I	J	K	L
1	INPUT DATA			PROBABILITY DISTRIBUTION OF DEMAND								
2	Selling price	5 €		Size of demand	Probability							
3	Buying price	3 €		500	0,1							
4	Loss on sale	1 €		600	0,25							
5				700	0,25							
6	DECISIVE VARIABLES			800	0,3							
7	Order size	500		900	0,05							
8				1000	0,05							
9	SIMULATION											
10	Size of demand	Sales	The costs overestimation of demand	The cost of buying	PROFIT							
11	700	2500	0	1500	1000							
12												
13	The number of simulation	1	2	3	4	5	6	7	8	9	10	11
14	Demand	500	550	600	650	700	750	800	850	900	950	1000
15												
16	DESCRIPTIVE STATISTICS											
17	average profit, mean	1000	1068,5	1137	1126,3	1115,6	1026,3	937	752,9	568,8	368,8	168,8
18	StdDev	0,00	92,01	184,02	280,57	406,84	499,53	612,77	633,33	660,14	660,14	660,14
19	Max	1000	1100	1200	1300	1400	1500	1600	1700	1800	1600	1400
20	Min	1000	800	600	400	200	0	-200	-400	-600	-800	-1000

Acta Logistica - International Scientific Journal about Logistics
Volume: 2 2015 Issue: 4 Pages: 1-6 ISSN 1339-5629

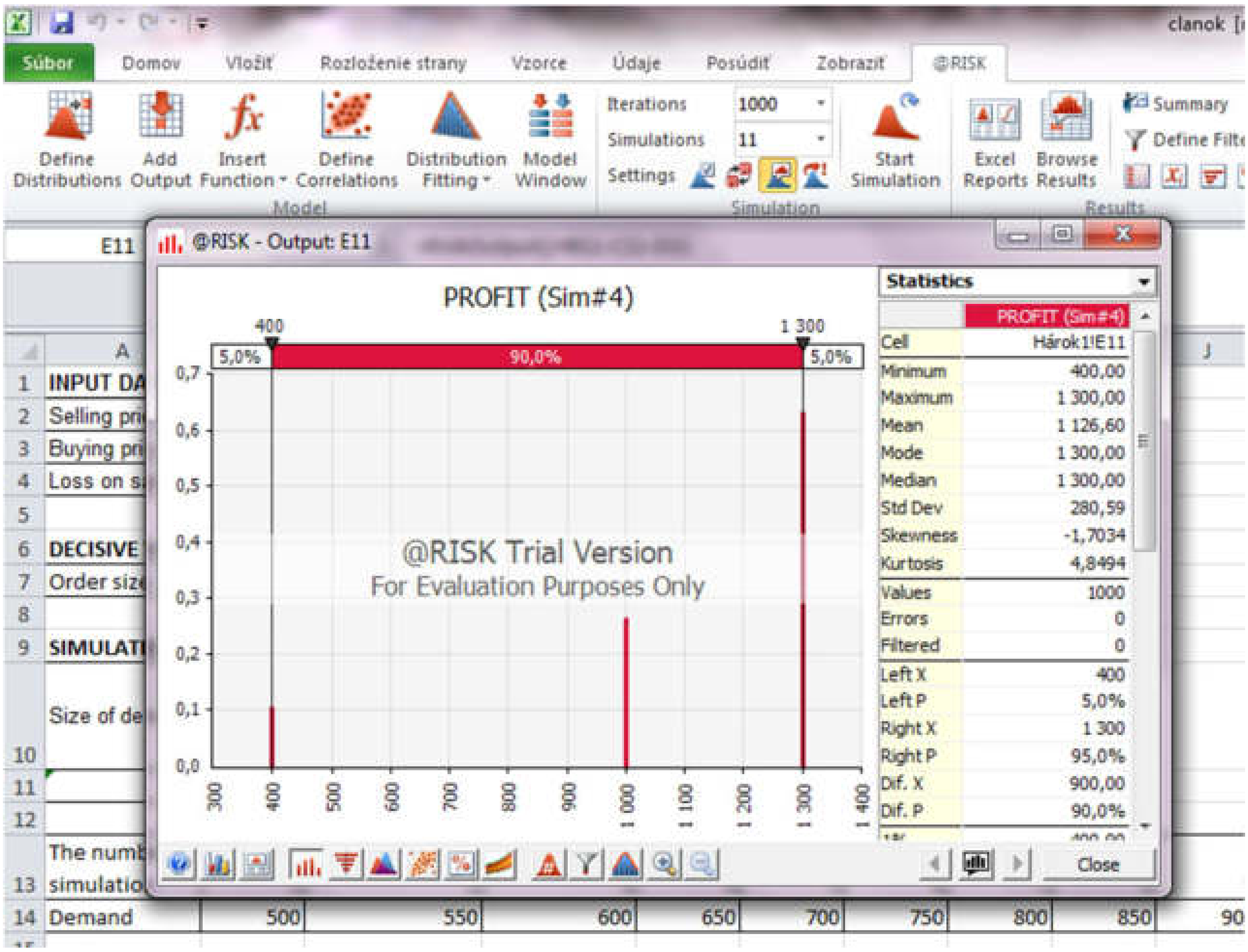


Figure 5 @Risk simulation system, results of simulation (number 4)

RiskMin. When inserting function of descriptive statistics order number of simulations is used, in a first row – Data source – address of output E11 is fixed in a second row – Sim – address of order number is not fixed. Subsequently these functions can be copied into the cells B17:B20 into C17:L20.

The simulation can be run thought top menu @Risk – Start Simulation, after running are depicted in Excel sheet values of given function and simultaneously is shown window with values of different descriptive statistics together with their graphical representation (Fig. 5).

The overview table of results from all simulations is in the Fig. 6. After creating of simulation model and comparing results of simulation the highest risk is for the order of 600 pieces.

Volume: 2 2015 Issue: 4 Pages: 1-6 ISSN 1339-5629

@RISK - Results Summary

Inputs Outputs

Simulation Results For Outputs:

Name	Cell	Sim#	Graph	Min	Mean	Max	5%	95%	Errors
PROFIT	E11	1		1000	1000	1000	1000	1000	0
PROFIT	E11	2		800	1068,5	1100	800	1100	0
PROFIT	E11	3		600	1137	1200	600	1200	0
PROFIT	E11	4		400	1126,6	1300	400	1300	0
PROFIT	E11	5		200	1116,2	1400	200	1400	0
PROFIT	E11	6		0	1026,9	1500	0	1500	0
PROFIT	E11	7		-200	937,6	1600	-200	1600	0
PROFIT	E11	8		-400	753,2	1700	-400	1700	0
PROFIT	E11	9		-600	568,8	1800	-600	1800	0
PROFIT	E11	10		-800	368,8	1600	-800	1600	0
PROFIT	E11	11		-1000	168,8	1400	-1000	1400	0

Figure 6 @Risk simulation system, table of the simulation results

Conclusions

The article is an example of using the software simulation @Risk designed for simulation in Microsoft Excel spreadsheet, demonstrated the possibility of its usage in order to show a universal method for problem solving. A simulation is an important and has a stable place in the production process and also in business practice. It is not a tool to solve all the problems, but could be used to quickly optimize and improve. In this paper, a simulation model is assembled with add-ons @Risk the construction of the simulation model presented concrete examples. After the defection simulation and evaluation of results can determine the size of the order.

Acknowledgement
This article was created by implementation of the grant project KEGA 004TUKE-4/2013 *"Intensification of modelling in teaching II. and III. degree in the field of study 5.2.52 Industrial Engineering "*.

References

[1] NELSON, B. L.: Stochastic Modeling: Analysis and Simulation, McGraw-Hill, 1995.
[2] NEZBEDA, I. a kol.: Úvod do počítačových simulací. Metody Monte Carlo, Karolinum UK Bratislava, p.204, 2003. (original in Slovak)
[3] PEKÁR, J.: Softvérová podpora rozhodovania v prostredí Microsoft Excel, EKONOM Bratislava, 2010. (original in Slovak)
[4] TREBUŇA, P. a kol.: Modelovanie v priemyselnom inžinierstve, TUKE, p.195, 2015. (original in Slovak)
[5] STRAKA, M.: Diskrétna a spojitá simulácia v simulačnom jazyku EXTEND [online], Košice: TU FBERG, Edičné stredisko/AMS. 2007. (original in Slovak)
[6] SZABO, S., FERENCZ, V., PUCIHAR, A.: Trust, Innovation and Prosperity. In: Quality Innovation Prosperity, Kvalita Inovácia Prosperita, Vol. XVII, No. 2, pp. 1-8, 2013.
[7] CHMELÍKOVÁ, G., BOŽEK, P., HRDLIČKOVÁ, Z.: Multimedia Applications - Efficient Tool for Students and Teachers. In ICT for Language Learning, 4th International Conference, Florence, p. 5., 2011.
[8] www.palisade.com

Review process
Single-blind peer reviewed process by two reviewers.

Acta Logistica - International Scientific Journal about Logistics
Volume: 2 2015 Issue: 4 Pages: 7-12 ISSN 1339-5629

LAYOUT AND DESIGN OF ELECTROMOBILE CHARGING STATIONS AS URBAN ELEMENTS

Tomáš Chovan
Institute of Logistics, Faculty of Mining, Ecology, Process Control and Geotechnology, Technical University of Košice, Park Komenského 14, 043 84 Košice, Slovak Republic, tomas.chovan1@gmail.com
Martin Straka
Institute of Logistics, Faculty of Mining, Ecology, Process Control and Geotechnology, Technical University of Košice, Park Komenského 14, 043 84 Košice, Slovak Republic, martin.straka@tuke.sk

Keywords: electromobile, charging station, urban elements, design, layout
Abstract: The contribution is dedicated to the processing of the problems of the insufficient charging for the electric vehicles within the concrete urbanistic centre. It brings a different perspective on the mobility, which is shown in the form of electric energy as the alternative for the needs of urbanization of the cities. It analyses electromobility, new technologies in the field of electric vehicles and the charging stations as the elements of the urbanism. In terms of the solution, the contribution is focused on the Košice city and the location of the public charging stations. Košice do not have sufficient amount of the public charging stations and until the 2014 there was only one public charging station. The contribution is focused on the designing of the parking places with the charging station placed on the appropriate parking places. The resulting design is created in the CAD system, it brings the view of the layout of the charging station at the shopping centre in the open space and in the parking house.

1 Introduction

This article follows the previous article titled “Analyse of electromobile charging stations for the neeeds of urban projection” from the 3rd issue 2015 [1].

The contribution is dedicated to the processing of the problems of the insufficient charging for the electric vehicles within the concrete urbanistic centre. It brings a different perspective on the mobility, which is shown in the form of electric energy as the alternative for the needs of urbanization of the cities. It analyses electromobility, new technologies in the field of electric vehicles and the charging stations as the elements of the urbanism. In terms of the solution, the contribution is focused on the Košice city and the location of the public charging stations.

2 Multi-criteria decision making as means to sulution of charging stations allocation and layout

In order to reduce number of suitable points for charging stations i this used a couple of indirect multi-criteria decision making methods, specifically, the pairwise comparison method with allowed parity of values of weighting criteria (MPP method) and Saaty method. Saaty method was used in order to verify the previous method. Saaty method also gives more accurate values than in the case of MPP method. Each criteria have been marked alphabetically, A - shopping centres, B - post offices, C - the authorities, D - health care institutions, E - other major places.

By Saaty method is based on comparison 2 criteria each other. The evaluation of results is done by 9 different grades (Table 1).

Table 1 Description of points scale, Saaty method

Points x	Description
1	The criteria are equally important
3	The first criterion is slightly significant than the second criterion
5	The first criterion is quite significant than the second criterion
7	The first criterion is much significant than the second criterion
9	The first criterion is absolute significant than the second criterion
	For the finer distinction can be used values 2, 4, 6, 8

Table 2 The total score in the whole matrix and counting of values in each columns, Saaty method

Criteria x_i	A	B	C	D	E
A	1,00	9,00	7,00	5,00	5,00
B	0,11	1,00	0,33	0,20	0,14
C	0,14	3,00	1,00	0,20	0,11
D	0,20	5,00	5,00	1,00	5,00
E	0,20	7,00	9,00	0,20	1,00
Sum	**1,65**	**25,00**	**22,33**	**6,60**	**11,25**

Table 3 Calculate new values of the matrix and calculation of standardized weights for each criterion, Saaty method

Criteria x_i	A	B	C	D	E	Sum	Standardized weights α_i
A	0,60	0,36	0,31	0,76	0,44	**2,48**	**0,496**
B	0,07	0,04	0,01	0,03	0,01	**0,17**	**0,033**
C	0,09	0,12	0,04	0,03	0,01	**0,29**	**0,058**
D	0,12	0,20	0,22	0,15	0,44	**1,14**	**0,228**
E	0,12	0,28	0,40	0,03	0,09	**0,92**	**0,185**
Sum	**1,00**	**1,00**	**1,00**	**1,00**	**1,00**	**5,00**	**1,00**

The most important is criterion A. It is followed by criteria D, E, C and B (Table 2, Table 3 [2]). Using multi-criteria decision making, it is clear that the appropriate place for charging station layout is actually shopping centres. There are 43 shopping centres marked on the map. Therefore, an additional criterion was used - large enough car parks - which had the effect on selection of sites for allocation. Considering that additional criterion in the city of Košice there are just 16 large enough car parks. However, only 11 large enough car parks are close to the shopping centres. The remaining 5 car parks falls within the criteria “other major places”. Points on the map (Figure 1) symbolize some of the five criteria, additional criteria - large enough parking place, the core point, etc... The decisive role point indicates the place of potential midway between three or more points. It symbolizes the parking area with multiple parking spaces or an open area where it would be possible to create several parking spaces for electric vehicles. Just large car parks have priority while in early stages of building of charging stations for electric vehicles.

With the growing number of electric vehicles on the road it will be necessary to extend the network of charging stations. Due to the price, the classical charging stations will prevail at the beginning. After the launch of the second phase of electromobility the demand of users will lead to fast-charging stations with an output of 22kW and charging time of around one hour or with an output of 44kW and charging time about 30min. Building of charging network in a several stages appears to be an ideal solution. Network building will be subjected to the result of a multi-criteria decision making. Master plan should by adapt according to the multi-criteria decision making results. For newly constructed buildings with adjacent car parks the charging stations will be considered in the phase of project.

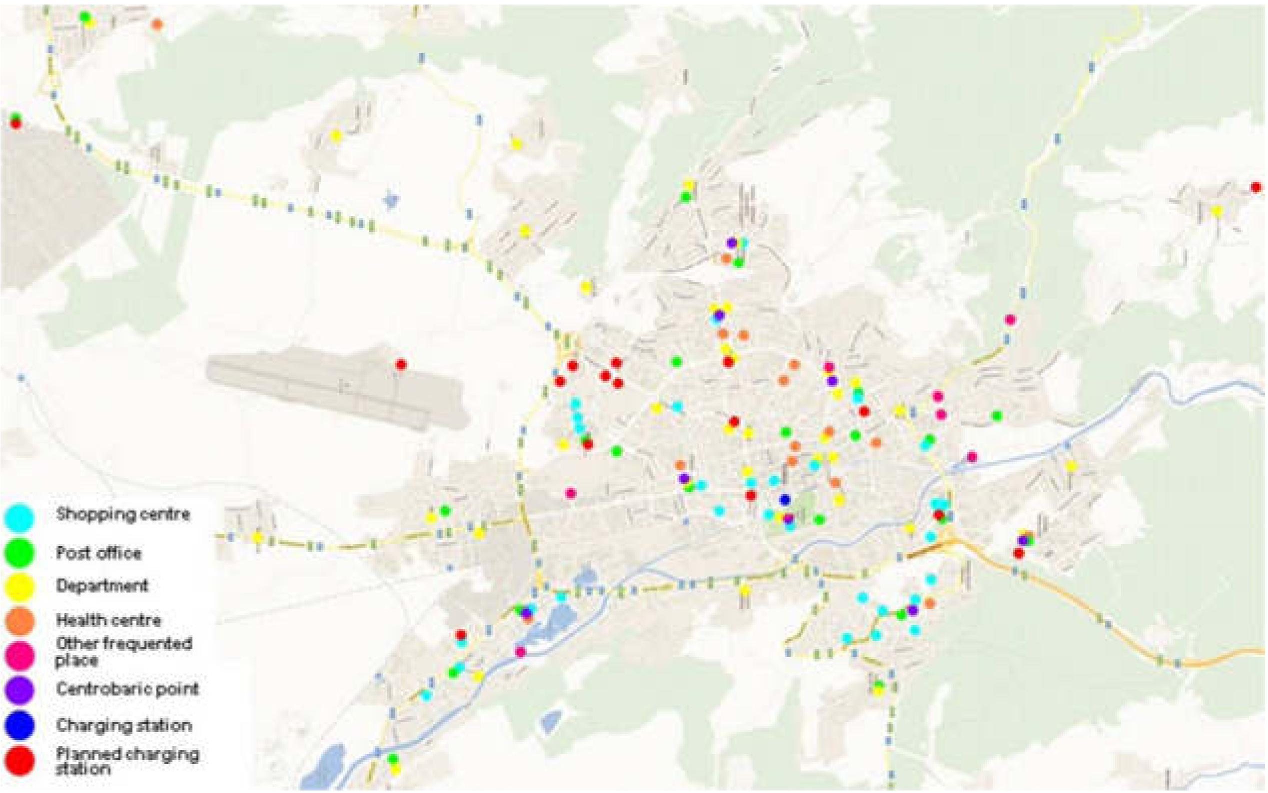


Figure 1 Marked points, layout of charging places building for electric cars in Kosice [2]

3 Project of parking places impact on urban planning for the needs of electromobility in Košice

The parts that are appropriate for the charging stations were chosen with the help of allocation. The allocation is followed by the layout, which sets the specific distribution of the stations throughout the town districts. All 22 town districts were used for the purposes of this work, which contained 5 criteria. Potential locations for charging the electromobile were added to the criteria – shopping centres, post offices, offices, healthcare facilities, other frequent locations.

There was also applied one additional criterion – adequate size of the parking area. According to the criteria, 137 potential points for the charging stations, from which, with the help of multi-criteria decision making methods (method of pairwise comparison, Saaty method), there were chosen 16 points, that are suitable for the construction of the charging stations in the second phase of electromobility. The second phase of electromobility consists of the construction of the charging infrastructure itself.

Table 4 Positions, which are suitable for the construction of the charging station in Košice

Numbers	Positions
1	Aupark (Liberator's square)
2	Baumax (Moldavská route)
3	Hornbach (Moldavská route)
4	Hypermarket Tesco (Trolejbusová street 1)
5	Kaufland (Popradská street 92)
6	Kika (Moldavská route)
7	Letisko (Čkalovova street)
8	Metro (Americká trieda 1/A)
9	OC Cassovia (Pri Prachárni 4)
10	OC Galéria (Toryská street 5)
11	OC Optima (Moldavská street)
12	Technická univerzita v Košiciach (Letná 9)
13	Tesco (Napájadlá 16)
14	U. S. Steel (Entry areal of U. S. Steel)
15	Ice stadium of Ladislav Troják (Nerudova street 12)
16	ZOO Košice (Široká 31)

Every point is specific. There are several factors affecting every point, which all allow us to use a specific type of charging technology. Inductive charging and photovoltaic panels are a future vision in our country. There is a lack of charging stations in Košice and generally in the whole Slovakia. There are not enough classical and fast-charging stations. Therefore the choosing was narrowed down to this two charging technologies.

On some points, classical charging stations might be inadequate. The fast-charging stations are not needed on all places. Classical charging stations can be chosen according to the initial costs. How to decide? Where to use the particular charging technology? In order to simplify the choosing between the classical and fast-charging technology, indirect multi-criteria decision making method was used, specifically the method of pairwise comparison with allowed equality of values of criteria weight.

Defined criteria:

A – initial costs - This criterion was chosen from one reason. The cost difference between classical and fast-charging station is quite big. The candidate of extending the parking area with electromobile parking places will have to decide whether he buys one fast-charging station or several classical charging stations.

B – effectivity / speed of charging – There is a difference between charging the vehicle for 4 to 5 hours and 30 to 60 minutes.

C – usability (location of the parking place) – The charging station, which is located in a underground garage will prevent the candidate from additional costs. It does not need water-proof and dust-proof facilities.

D – charging time (available activities) – It is important, that the owner of a electromobile had several options of spending his "free" time during the charging.

E – maintenance – Fast-charging station has higher maintenance costs that the classical.

4 The First Level Heading 12 pt, Left

The purpose of design of the parking places is standardization, which brings unifying of the concept of electromobility and lowering of the costs, which are needed to construct the networks of charging stations not only in Košice. Before the realization of the parking places project, it is necessary to notify SPP, VVS and the telecommunications, whether the particular place for the charging stations and the excavation works involved do not affect the projects of this companies on the particular parking area. This parking area can be situated on a vacant area or in a parking house. The design was processed for both types.

Parking places shall be designed with longitudinal, diagonal or vertical queueing of vehicles (Figure 2).

Volume: 2 2015 Issue: 4 Pages: 7-12 ISSN 1339-5629

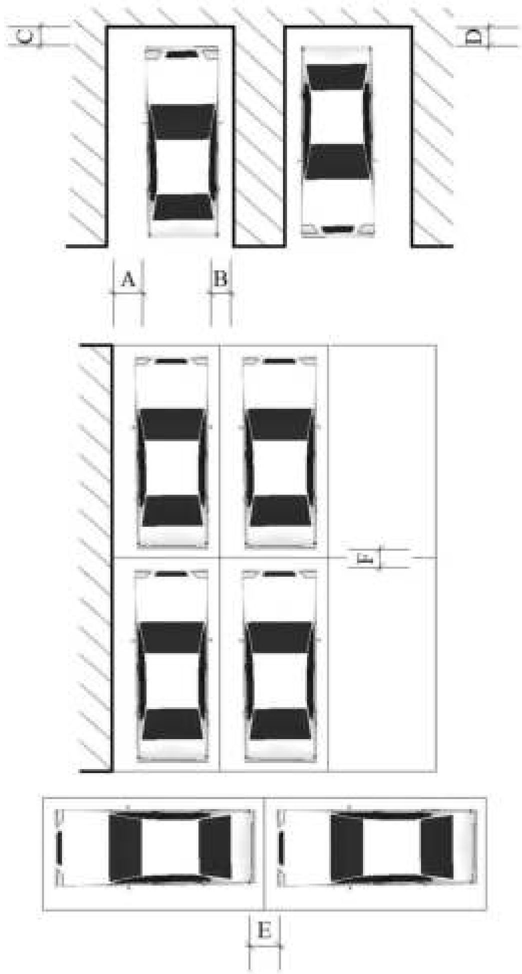


Figure 2 Parking places and their projection [3]

Outside parking areas create the base of suitable places for the allocation and layout of the charging stations in Košice. From the 16 chosen places, 14 of them is situated outside, 10 of those near shopping centres. This design is operating with the parking places for electromobiles in front of shopping centres. The area for parking places should be as close to the entrance to the shopping centre as possible. It would be a benefit for the electromobile owner and the electromobility would be visualized and brought to the awareness of people and potential customers. This allocation within the parking area is going to affect the costs, especially the costs for the excavation works and used material. According to the preview of the design, the position of electromobile parking place was at the Tesco hypermarket (Trolejbusová street 1) (Figure 3). The parking place was designed near the entrance to the shopping centre. The second phase of electromobility,– the construction of charging stations near the Tesco hypermarket counts with 4 reserved parking places and 2 charging stations [4].

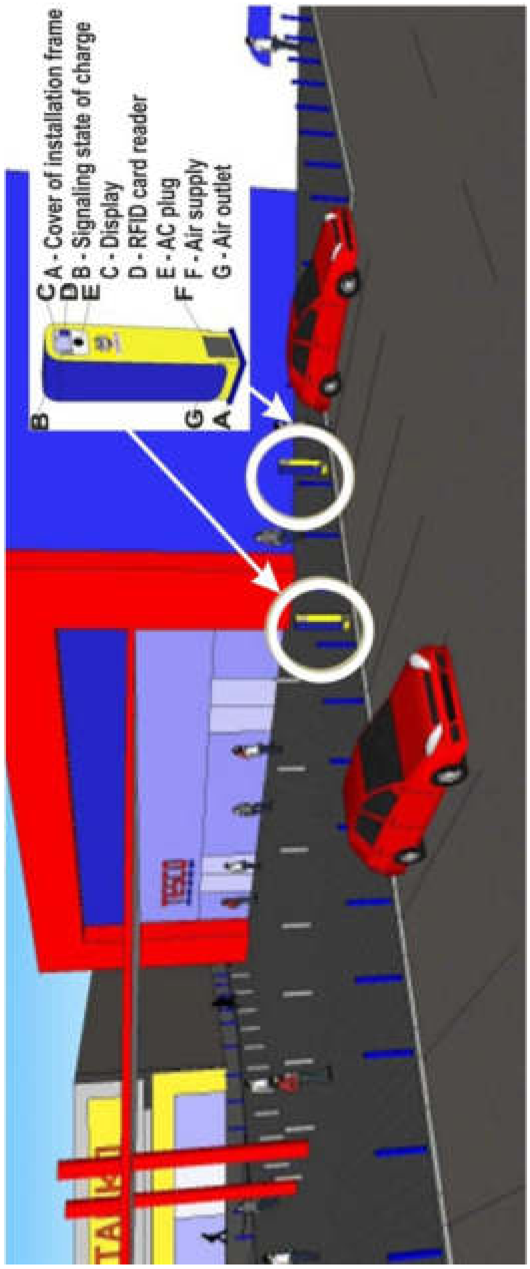


Figure 3 Location of two charging stations near the Tesco hypermarket

The excavation works will be done in thee complete length of 6.6 m (the length between the stations is 4.8 m and the length between the stations and the building is 1.8 m). The cable will be places into sand lode and marked with a foil. The whole length of the cables will be cca 20 m. The project of construction of the new parking places requires a planning permission. The documentation has to be verified in the construction proceedings. From 16 places, that were chosen, two of them are situated in a parking house (Shopping Centre Aupark, Ice stadium of Ladislav Troják). The parking house in the shopping centre Aupark is a frequent place situated near the downtown. The location of the charging station on this place is important and has a strategic character according to the shopping in this shopping centre and thanks to the free parking for 3 hours, the vehicle can be charged here while the owner can do all the necessary things in the downtown.

The location of the parking places should be situated close to the escalator in the first underground floor of the shopping centre. It would bring the same benefit as with the outside parking areas. The electromobility would be visualized and brought to the awareness of people and potential customers. The second phase of electromobility – the construction of charging stations near the shopping centre Aupark counts with 6 reserved parking places and 6 charging stations (Figure 4) [4]. The charging stations will be connected by a 12 m long cable (which corresponds to the length of 5 parking places). One of the charging stations will be connected to the power distribution box by a cable with a length of 20 m.

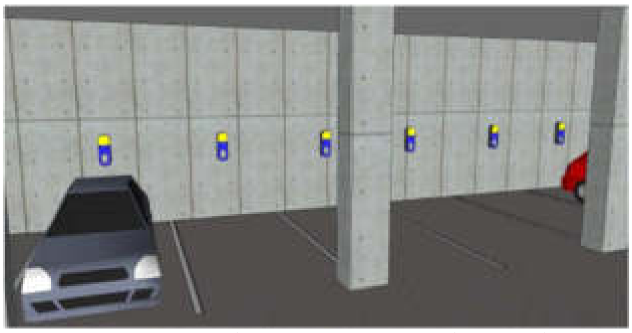


Figure 4 Location of charging stations in underground garage of a shopping centre

The parking place for charging electromobiles consists of several elements (Figure 5). Classical charging station requires the area of 500 x 400 mm. This area can be calculated with the following method:

- the size of the charging station is (H x W x T): 1460 x 300 x 200 mm,

- 100 mm are required from every side.

It is necessary to take the necessary precautions in order to prevent things and weather conditions from blocking the air circulation.

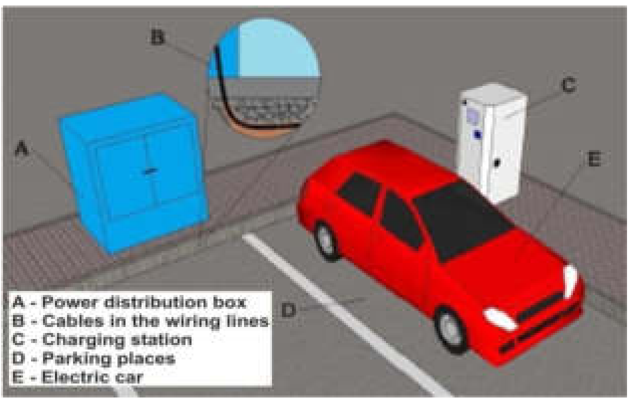


Figure 5 Design of the area for electromobile charging

Fast-charging station Terra requires the area of 1730 x 1460 mm. This area can be calculated with the following method:

- The size of the station is (H x W x T): 1900 x 760 x 525 mm,

- the front side requires an extra space of 600 mm, in order to be able to access the panel from the front side,

- left and right side require an extra space of 600 mm, in order to be able to access the panel from the left and right side,

- the back size requires an extra space of 100 mm, in order to ensure the air circulation,

- the fast-charging station has the air entrance on the right side and the air exhaust on the back size.

It is necessary to take the necessary precautions in order to prevent things and weather conditions from blocking the air circulation. Electrical installation has to be finished according to the electrotechnical security and legal rules. The cable diameter (depending on the length of the cable and the distance from the source), the way of installation is set by the supplier.

Conclusions

Space for the electric vehicles should be situated as closest to the entrance of the shopping center as it is possible. It would be a benefit for the owner of the electric vehicle and the electromobility would be visualized by such a way and would be brought to the awareness of the people and potential customers. This allocation, within the parking place, will have the impact on the costs, concretely on the excavation works and the material used. The result of the project of the parking places is the standardization, which will unify the conception of the electromobility and the reducing of the costs needed for construction of the charging station networks in the Košice.

Parking places for the electric vehicles were variant designed on the free spaces and in the parking houses based on the analysis and there was designed graphical design of the charging stations. The work brought another view to the mobility, which is shown in the form of the electric energy, analyses the electromobility, new technologies in the field of the electric vehicles and the charging stations, thereby it meets the goal to inform, to get the electromobility into the awareness of the wide public. Based on the five criteria the appropriate technology of charging was selected with the form of a classical charging station or fast-charging station with the help of the pairwise comparison method. The location of the charging stations was previewed with the form of a graphical design. The projecting of the location of the charging stations designed within this article might help by the creation and projecting of the electromobility not only in Košice or Slovakia.

Acknowledgement
Publication has been created with the support of VEGA grant agency, in the framework of grant task VEGA 1/0036/12 "Methods development and new approaches to design of input, interoperable and output warehouses and their location in mining, metallurgy and building industries" and grant task VEGA 1/0216/2013 "Methods and new approaches study to measurement, evaluation and diagnostic performance of business processes in the context of logistics management company".

References

[1] STRAKA, M., CHOVAN, T.: Analyse of electromobile charging stations for the neeeds of urban projection. Acta Logistica, Vol. 2, No. 3, pp. 17-20, 2015.
[2] CHOVAN, T.: Alocation and layout of electric places for the needs of electromobiles in Kosice, 2012. (Original in Slovak)
[3] STN 73 6056: 1988, Parking spaces and parking positions of road vehicles. 1988. (Original in Slovak)
[4] CHOVAN, T.: Project of parking places for the needs of electromobiles in Kosice, 2014. (Original in Slovak)

Review process
Single-blind peer reviewed process by two reviewers.

Acta Logistica - International Scientific Journal about Logistics
Volume: 2 2015 Issue: 4 Pages: 13-16 ISSN 1339-5629

HOURLY STABILITY ANALYSIS AS THE KEY PARAMETER OF LEAN MANUFACTURING AND LOGISTICS

Petr Besta
University of Entrepreneurship and Law, Michálkovická 1810, 710 00 Ostrava, Czech Republic, petr.besta@vspp.cz
Kamila Janovská
University of Entrepreneurship and Law, Michálkovická 1810, 710 00 Ostrava, Czech Republic, kamila.janovska@vspp.cz
Petr Prosický
VSB - Technical University of Ostrava, Ostrava, Czech Republic, EU, petr.prosicky.st@vsb.cz
Lukáš Hula
VSB - Technical University of Ostrava, Ostrava, Czech Republic, EU, lukas.hula.st@vsb.cz

Keywords: production, costs, logistics, price, wasting

Abstract: Lean manufacturing belongs to the basic philosophies originating in automotive industry. It was originally based on a number of elementary principles and methods. Companies from other industrial areas have also been gradually trying to apply these principles. This leads to the incorporation of other tools from various areas into this concept. The fundamental techniques of lean manufacturing include the hourly stability (output) analysis. This method can be applied in a wide variety of manufacturing fields. The aim is a stable working worker, not a worker working rapidly and with large fluctuations. Speed and sudden changes mean inaccuracy, poor quality and problems to the manufacturing companies. The research has also carried out the hourly stability analysis in a company manufacturing components for a variety of global car manufacturers. The objective of this article is to evaluate the research of hourly stability for the selected workplaces.

1. Introduction

Company leanness means doing only those activities that are necessary, doing them right the first time, doing them faster than the others, while spending less money [1]. The current competitive environment puts enterprises under great pressure [2], [3]. However, it is not possible to consistently build your company simply by using cost reductions. Leanness is about improving the performance of the company by producing more than the competitors in the given space, by producing higher added value than the competitors with the given number of people and equipment, by processing more orders during the given time, and by consuming less time on the individual company processes and activities [4]. It is therefore important to do exactly what the customer wants, with a minimum number of activities and at minimum costs. Being lean therefore means earning more money, earning it faster and with less effort [5]. More and more manufacturing companies realize that without fundamental changes in their processes, their existence in the near future may be at risk [6], [7].

2. Lean manufacturing tools

Lean manufacturing and its principles cannot be understood as a clearly defined and closed system. This philosophy allows you to apply a variety of methods and tools, and it is also possible to use very different approaches during its implementation [8]. The implementation of lean manufacturing is mostly a reaction to some kind of problem in the organization. It is often recommended during the implementation of lean manufacturing principles to use a procedure based on the initial audit of the basic parameters of lean manufacturing, where the values of the selected indicators can be determined. According to contemporary approach, lean manufacturing is a complex system that can evaluate a variety of aspects and parameters, including the indicators assessing the quality of the individual processes, the amount of downtime, but also for example the variability of the production performance [9], [10]. Lean manufacturing uses tens of tools and metrics for this purpose. The most commonly used ones are: the amount of non-conforming production, the OEE of selected workstations, the set-up times, the inventory turnover rate, the hourly stability, the continuous production time, and the C/T of bottlenecks. Their application must, however, always be based on the specific aspects of each organization. A number of parameters which are used to assess the production leanness rely on the principles of mass production, and it is therefore very difficult to apply them for example in individual piece production [11], [12]. That is why it is always necessary to use the individual approach when applying the lean manufacturing tools. Special attention must be paid to the methods and techniques used within the scope of lean manufacturing. Originally, these techniques were applied in the production of automobiles. The application of the

Acta Logistica - International Scientific Journal about Logistics
Volume: 2 2015 Issue: 4 Pages: 13-16 ISSN 1339-5629

principles of lean manufacturing in other areas was also accompanied by an increasing number and scope of the applied methods [13]. There are dozens of different methods used nowadays. The most typical and frequently used ones include, for example: TPM, 5S - a system of good management, visual management, team problem solving, batch production, management of bottlenecks, and many others. The concrete use of the individual methods is again quite dependent on the character of the manufacturing organization in question.

A different nature of the production process does not allow a universal application of all the methods.

3. Hourly stability

The basic tools of lean manufacturing include hourly stability. This tool, in essence, shows the stability of the planned performance for each hour during a work shift. This indicator is monitored especially on a problematic production line (machine) or in a bottleneck. High fluctuations in the performance of workers may be associated with a higher degree of non-conforming production. It is important for a worker to work evenly during the work shift, thus avoiding fluctuations in performance. Generally, the reasons for the monitoring of hourly stability can be summarized as follows:

- using shorter time intervals makes it possible to effectively identify the causes of the problems (downtime due to failure to deliver material, breakdowns of machines, tools),
- process improvement,
- long-term trend monitoring,
- identification of key problems,
- comparison of the performance of more workers.

The calculation of hourly stability *HS* can be performed using equation (1). The result is a percentage value and it represents the rate of fluctuation of real performance compared to the planned one.
Hourly stability can be calculated as:

$$HS = \frac{TNPPQ}{TNPP} \times 100\ [\%] \tag{1}$$

TNPPQ - total number of pieces actually produced up to the planned quantity,
TNPP - total number of planned pieces.

The hourly stability indicator is usually used in the mass production environment, where the range of products is not very wide. They are workplaces (operations) where the given machine has a high production cycle. The utilization in the environment of frequent changes and high product variability is very limited.

4. Experimental part

The conducted research also involved a study in a company manufacturing components for the automotive industry. The hourly stability was measured at the selected workplace. The measurement was carried out during 10 shifts. The results were recorded and evaluated separately for each shift. Table 1 shows a report of a work shift from 28 November. The table shows the breakdown of the individual hours, the number of pieces that are scheduled for the shift, the actual number of pieces produced, and the actual hourly amount up to the planned one. The used methodology of the hourly stability evaluation takes into account: the total actual number of pieces produced up to the planned amount and the total number of planned pieces (relation 1).

Table 1. Record of worker performance during the specified work shift

Working hours		Actual production		
Day	28. 11. 2015	Hourly plan (pcs)	Actual hourly amount (pcs)	Actual hourly amount up to planned amount
Number of minutes	Time period			
42	6.00 - 7.00	80	36	36
60	7.00 - 8.00	90	42	42
60	8.00 - 9.00	90	109	90
60	9.00 - 10.00	80	65	65
30	10.00 - 11.00	40	59	40
60	11.00 - 12.00	90	111	90
59	12.00 - 13.00	90	101	90
43	13.00 - 14.00	80	53	53
	Total	640	576	506

$$HS = \frac{506}{640} \times 100 = 79\ \% \tag{2}$$

The hourly stability for each shift was determined on the basis of these data. The calculation of the hourly stability for 28 November is displayed within the relation (2). The value of the hourly stability in this case is 79%. This value is at the limit of acceptability. It is generally acknowledged that the desirable hourly stability rate is above 80 %. Of course, it always depends on the specific production conditions.

Volume: 2 2015 Issue: 4 Pages: 13-16 ISSN 1339-5629

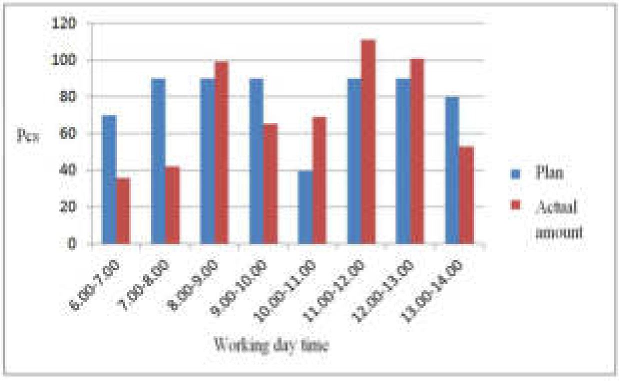


Figure 1 Comparison of the planned and actual production during 28 November 2015

Figure 1 provides a graphic illustration of the development of the planned and actual value of production using the given machine. The development clearly shows how big the difference is between the plan and the actual production. The same method was used to evaluate the hourly stability of the machine during the remaining 9 days.

Concrete values of hourly stability are presented in Table 2. The table also indicates the average hourly stability value during the monitored shift. The results show that there are significant fluctuations in the performance of the worker within the scope of the monitored machine. The value of hourly stability exceeded the required value of 80 % only in a single case.

Table 2. Record of worker performance during the specified work shift

Measurement number	Day	Hourly stability (%)
1.	28.11.	79
2.	29.11.	75
3.	30.11.	81
4.	1.12.	71
5.	2.12.	68
6.	3.12.	74
7.	4.12.	72
8.	5.12.	68
9.	6.12.	70
10.	7.12	76
	Average	73,4

The value rather approached 70 % during most of the monitored days. The average value of the hourly stability during the monitored period is 73.4 %. This can be regarded as totally inadequate.

A secondary analysis, which evaluated the individual parts of the work shift, was conducted on the basis of this survey. After the comparison of the results of all the monitored days, it was discovered that the largest fluctuations had usually occurred in the first two hours of the shift. During this time, the workers using the machine showed the largest deviations from the desired - planned values. A follow-up analysis of the non-conforming products was performed afterwards, and it has revealed that they did not occur at the end of the shift, when the workers tried to make up for the lost time. The inefficiency during the first two hours of the shift was caused by the fact that there were no managers (foreman) present at the workplace at that time. This was due to the fact that the company had switched to a five-shift operation and it was not possible to secure sufficient number of foreman at the workplace in certain time of the working day.

The higher occurrence of non-conforming products, however, had been the impetus for tracking the hourly output, which eventually revealed the concrete cause. Considering the huge requirements of companies in the automotive industry, the possible long-term solution to the issues related to non-conforming production could have a major impact.

Conclusions

The analysis of hourly stability of the performance of a worker (machine) can provide key information for production management. It is often very difficult to identify the cause of the problem without a detailed and exact analysis. The fluctuations in the performance of a worker during a work shift can have many negative consequences.

The crucial factors include the high occurrence of low-quality production, which is primarily the result of the fact that if a worker works slower during certain part of his shift, he tries to compensate for the performance reserve later. Increased performance over a short period of time logically brings lack of attention resulting in low-quality work (non-conforming products). The research carried out in the company engaged in manufacturing parts for the automotive industry has clearly demonstrated this fact. The increased amount of low-quality production has unambiguously been influenced by large fluctuations during the work shift.

The hourly stability as a fundamental tool of lean manufacturing enables simple identification and elimination of these problems. In the current highly competitive environment, it is always better to use and preventively apply the tools helping us to prevent any problems. An appropriate and timely performed preventive action is always cheaper than the subsequent solution of generally expensive problems.

References

[1] BAZALA, J. et al.: *Logistika v praxi*. Praha: Verlag Dashöfer, 2004. (Original in Czech)

[2] DAVIS, J. W.: *Lean manufacturing: implementation strategies that work: a roadmap to quick and lasting success*. Industrial Press Inc., 2009.
[3] HAVERLAND, J., HULA, L., BESTA, P.: Elementární metody klasifikace zásob. In *Recese-ekonomika-technologie.* Ostrava: Vysoká škola báňská – Technická univerzita Ostrava, 2010, p. 22-27. (Original in Czech)
[4] CHANDRA, CH., GRABIS, J.: *Supply chain configuration: concepts, solutions and applications*. Springer, 2007.
[5] KOŠTURIAK, J.: *Inovace – Vaše konkureční výhoda*. Praha: Computer Press, s.r.o., 2008. (Original in Czech)
[6] BESTA, P.; HULA, L.; ŠVAJDOVÁ, L.: Optimalizace nákupního procesu v průmyslovém podniku. In: *Inovace a zlepšování v podmínkách ekonomické krize.* Ostrava: Vysoká škola báňská – Technická univerzita Ostrava, 2011, p. 4-7. (Original in Czech)
[7] PERNICA, P.: *Logistika pro 21. století*, 2. díl. Praha: Radix, s.r.o., 2005. (Original in Czech)
[8] PERNICA, P.: *Logistika pro 21. století*, 3. díl. Praha: Radix, s.r.o., 2005. (Original in Czech)
[9] SZABO, S., FERENCZ, V., PUCIHAR, A.: Trust, Innovation and Prosperity. In Quality Innovation Prosperity / Kvalita Inovácia Prosperita. Vol. XVII, No.2, p. 1-8, 2013.
[10] WILSON, L.: *How to implement Lean Manufacturing.* McGrawHill Professional, 2009.
[11] PERINIĆ M., IKONNIĆ M., MARIČIĆ I.: Die casting process assessment using single minute Exchange of diees (SMED) method. *Metalurgija*, Vol. 48, No.3, 2009, pp. 199-202.
[12] LENORT, R., BESTA, P.: Logistics of End of Life Electronics Equipment Disassembly. *Acta Montanistica Slovaca*. 2009, Vol. 14, No. 3, pp. 268-274.
[13] MONCZKA, R, M.; HANDFIELD, R., B.; GIUNIPERO, L.: *Purchasing and Supply Chain Management*. Cengage Learning, 2008.

Review process
Single-blind peer reviewed process by two reviewers.

MANAGING INNOVATION PROJECTS USING DISTRIBUTION LOGISTICS

Erika Loučanová
Department of marketing, trade and world forestry, Technical University in Zvolen, T.G. Masaryka 24, 960 53 Zvolen, Slovak Republic, loucanova@tuzvo.sk

Keywords: innovation, project management, innovation management, distribution logistics, logistics
Abstract: A significant part of innovation projects management is the distribution logistics. From the point of view of time and material content, the properly chosen way of distribution is one of many factors for success of the project and innovation creation itself. The paper points out the fundamental basis of innovation management in the stage of its realization referring to the importance of distribution logistics in this part of innovation project management. Distribution logistics in the project management provides comprehensive solutions to efficiency of tangible relocating processes in all connections and mutual relations of project in order to maintain compliance between economy and business when implementing innovations.

1 Introduction

As stated by Chudada a Tarabová [1], in today's uncompromising competition, successful may be only the one, who puts the emphasis on continuous development and improvement of its products by innovations. Innovation of products is closely related to the market and its orientation towards the customer. Nowadays, a project is considered to be the main tool for achieving this change (innovation), because as stated by Filo [2], the current state – new state = change; change = plan + realization and plan + realization equals to the project. In case that this change is positive, for society it represents an innovation as such. Realization of the project for creation of innovation represents an implementation of project plan based mainly on organizing resources, more specifically human, material, financial and also information resources. This task in the project management for creation of innovation is then represented by distribution logistics, which searches for the optimal topologies of distribution network for the project and the actual implementation of innovation.

2 Use of distribution logistics in the project management of innovation

Success of implementation of the project is to a considerable extent dependent on the quality and competences of a project team as well as on ability to communicate within an open system of innovation process with respect to its more initiative environment. Regarding more pulse environment arising from its open innovation system, it is necessary to have all activities of the project within its implementation organized and it is necessary to create a summary of tasks related to logistics and measures related to the environmental factors such as production program, space, demand, supply, transportation availability, time etc. From the perception of project management for creation of innovation the distribution logistics fulfills two basic tasks from economic point of view. The first one is related to the creation of innovation value itself, i.e., creation of quantitative or qualitative special – purpose change. The second task is focused on realization of distribution flows in the project, creating the balance between demand and supply, i.e., in project management it is realization of the flows between resources and consumers. Finally, an implementation of the project and distribution logistics fulfilment of mentioned tasks are ensuring deliveries at the right time, in the right place and exactly with what is expected by the market. This ability is called FIT, i.e., meaning that the project team should be flexible, innovative and it should implement its activities at the right time. The functions of distribution logistics for implementation of project innovation in space, time, quantity and quality are flow of real outputs of individual activities of the project, flow of nominal outputs and flow of information. Flow of real outputs of individual activities of the project represents the movement of these outputs from one place to another, or as an output of one activity representing input of other activity of the project.
Considering the time, the flow of real outputs represents organizing inventories, respectively, outputs timing for their entry into another activity of the project for creation of innovation. At the flow of nominal outputs, from the perspective of the function of distribution logistics at innovation projects at space, logistics represent the transfer of financial resources from place to place, respectively, among the activities of the project, and from the viewpoint of time it comes to refinancing of these activities and a proper organization of financial coverage of project's activities (e.g. loans and others). Similarly, also the information plays an important role in project implementation and innovations, where the function of the flow of information within the distribution logistics ensures also the flow of information within the project's activities from place to place and from time point of view

storing and making a backup. All outputs of above – mentioned functions of distribution logistics in managing innovation projects must be at required quantity and quality. Parameters of quality and quantity may differ according to the type of project's activities, type of projects and, of course, type of innovation (Figure 1) [3], [4], [5].

Table 1 Matrix of length
Source: Loučanová by Straka [4], [5]

The functions of distribution logistics	Space	Time	Quantity	Quality
Flow of real outputs of individual activities of the project	The movement of outputs from one place to another, or as an output of one activity representing input of other activity of the project	Organizing inventories, respectively, outputs timing for their entry into another activity of the project for creation of innovation	Required quantity	Required quality
Flow of nominal project outputs	The transfer of financial resources from place to place, respectively, among the activities of the project	Refinancing of these activities and a proper organization of financial coverage of project's activities	Required quantity	Required quality
Flow of information in the project	The flow of information within the project's activities from place to place, or as an output of one activity representing input of other activity of the project	Storing and making a backup a information	Required quantity	Required quality

Comprehensively, in order for project management in conjunction with the management to successfully compete with the fierce competition it must satisfy the requirements of the market by delivering:

- the right innovation,
- in the right quality,
- in the right quantity,
- in the right place,
- at the right time,
- at the right price,
- and in the proper package.

This set of requirements known as "7 S Logistics" model, also used in the distribution logistics projects, represents an increase and optimization of the performance of the project for the implementation of innovations [6].

When talking about the current distribution logistics, it does not end by binding the innovations to the market, but it continues until the end of their life cycle. Because of this reason, we might talk about the next „S" of logistics in innovations, which provides service of this innovation until the end of its life cycle.

In addition to what was already stated, the innovations, within the distribution logistics, are also focusing on elimination of wastes, where eco - innovations enter the innovation process, whose mission is ecological disposal of used product, which is replaced by new one, respectively, increase of quality by innovations by reducing their impact on environment.

Even though there are many things changing according to a new perception, there are still some parts of them, which maintain their importance in their original perception, and in such case there is currently a new term entering the innovation management called retro – innovations, which partially slow down fast trend on the market and prevent from the shock from the future. By keeping the original essence of the product they are decreasing the pressure on all participating entities on the market emphasizing the innovation trends as well as increasing the level of customer service or lowering the expanses and some other trends and priorities. Malý states these trends in distribution logistics:

- global orientation,

- shortening the life cycle of the products by innovations, or by their re – innovation and creation of retro – innovation,
- lower level of inventories and orientation to just – in – time,
- electronic data processing and storage,
- market orientation,
- and waste elimination, where eco – innovations come to the fore [1], [8], [9].

When resulting from the global trends, it is possible to characterize also a new way of distribution based on the factors such as:

- stable demand and supply – for optimization of time structure,
- growth of transportation infrastructure – for optimizaion of space structure,
- formation of new time structures of pulse character, so called Boom of transportation market,
- formation of transportation waves, not reacting to each other – for creation of clusters increasing efficiency by cooperation,
- formation and creation of spires and hypercycles – for creation of consecutive development of logistics and creation of re – innovations, respectively retro – innovations,
- and creation of deterministic chaos [6], [7], [8].

All stated factors are referring to the actuality that there are always changes and pressure affecting innovation process from the market, customers and also investors. All participating entities are increasing the pressure in order to make all activities in the area of innovation more efficient and thus the pressure on innovation process is constantly growing and is increasing. Therefore, in order to make the innovations on the market successful, within the global optimization of innovation process and realization of the project, it is necessary to search for the optimal topologies of distribution network on known operating space.

By topology of distribution network in the innovation process in realization of the project we are clarifying and exploring the idea of connection within the intuitive cognition of fundamental characteristics of space and time for fundamental meaning of cognition of innovation realization. Therefore, for achieving competitive advantage through the application of all available methods and applications through distribution logistics for innovation realization, as a competitive advantage on the market, it is possible only in case of detailed analysis of the current state and subsequent confrontation of requirements of all participated entities [1], [6], [7], [8], [10], [11].

System analysis uses the principle of system research, systems theory and cybernetics to solve comprehensive technical, economic and organizational problems. System analysis methods are based on mathematical modelling, probability theory, operation analysis, graph theory and other exact methods. Studied case pays attention only to one coherent logistic operation for the project's activity. Securing logistics of the whole project is an inevitable binding of larger number of logistics operations of project's activities for realization of the innovation itself. Their bonds can be captured in network diagrams and the methods of analysis, known from graph theory, can be used. In these charts logistics activities of the given operation act as a whole. Critical Path Method - CPM or Program Evaluation and Review Technique – PERT are the methods, which are chosen very often for the network analysis [10].

Project for innovation realization represents the complex logistics system in space and time, by organizing the resources and except organizing of human resources within individual activities of the project and also the project as a whole, by which there is created so called concentrated market (Figure 2).

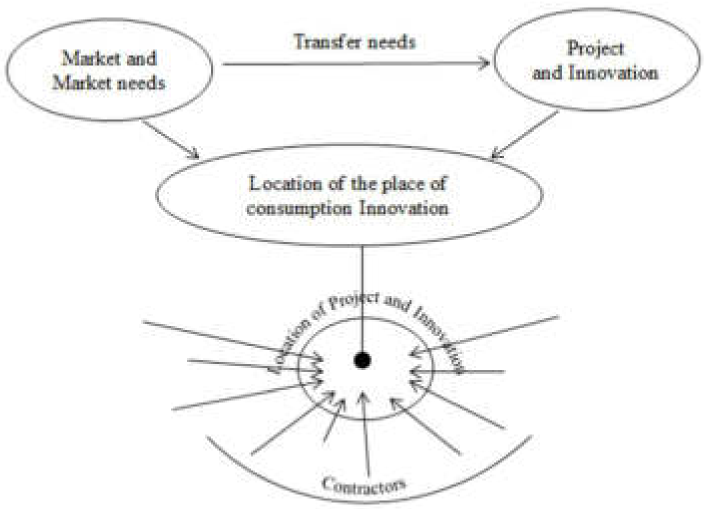


Figure 2 Concentrated market
Source: Loučanová by Filo [2]

Volume: 2 2015 Issue: 4 Pages: 17-20 ISSN 1339-5629

In case of projects within the distribution of mentioned flows, there is used tiered distribution of resources as Filo [2]:

- the first stage – represents connections of the project team with a bearer of needs, i.e. ordering party of the project. This stage represents pseudo – distribution where the provider of the project is connected with the receiver (customer) of the project itself,
- the second stage – flow of information, human and other resources necessary for the project,
- the third stage – flow of project users to the place of realization,
- the fourth stage – movement of the project team to the place of preparation and consequent realization of another project.

Within all stages of resources distribution for the project it is necessary to observe them by measurable parameters as intensity of distribution of resources in volumes, performance, supply and distribution variance, i.e. the number of starting places from where and where to the flow of resources is ensured and where and which methods of distribution are used, for example, as just-in-time states.

Conclusions

Logistics is now an important efficiency tool of the organization of individual project's activities for realization of innovations. Effective operation of the market cannot be considered without well-organized logistics network within the unified innovation process in the enterprise. Well-organized logistics chains in innovation projects represent higher chance of survival in the hyper-competitive environment by means of innovation.

From the above it is clear that the main integrating task of distribution logistics in the project management for realization of innovations is to ensure comprehensive solutions of physical processes transportation processes in all respects and mutual relations of the project, and maintain consistency between the economy and business.

References

[1] CHUDADA, M., TARABOVÁ, Z.: Distribution logistics – part of Supply Chain Management, *Logistický monitor*, May, p. 6, 2012.

[2] FILO, P.: *Marketing projektov,* Bratislava, Ekonóm, 2010. (Original in Slovak)

[3] LOUČANOVÁ, E., KALAMÁROVÁ, M.: *Projektový manažment a manažment inovácií,* Zvolen, Technická univerzita Zvolen, 2015. (Original in Slovak)

[4] STRAKA, M., MALINDŽÁK, D. et al.: *Distribution Logistics, Distribučná logistika*, Košice, Express Publicit, 2005. (Original in Slovak)

[5] STRAKA, M.: *Distribution Logistics, How effectively to put product into the market, Logistika distribúcie, Ako efektívne dostať výrobok na trh,* 1st edition, EPOS Bratislava, p. 400, 2013. (Original in Slovak)

[6] ŠTEFKO, R., RÁKOŠ, J.: *Logistics and its importance for corporate management*, Zborník vedeckých prác katedry ekonómie a ekonomiky ANNO 2008, Prešov, Prešovská univerzita, pp. 333 - 371, 2008.

[7] LOUČANOVÁ, E.: Retro-inovácie ako fenomén, *Posterus,* Vol. 6, No. 11, p. 5, 2013. [online] Available: http://www.posterus.sk/?p=16508 [20 Oct 2015], 2013. (Original in Slovak)

[8] LOUČANOVÁ, E., TREBUŇA, P.: Eko-inovácie ako nástroj konkurencieschopnosti, *Transfer inovácií,* 2014, No. 29, pp. 76-80 [online] Available: http://www.sjf.tuke.sk/transferinovacii/pages/archiv/transfer/29-2014/pdf/076-080.pdf [23 Oct 2015], 2014. (Original in Slovak)

[9] KAVKA, L.: System Analysis of Logistic Processes, *Acta Logistica Moravica,* Vol. 1, No. 1 [online] Available:http://web2.vslg.cz/fotogalerie/acta_logistica/2012/1-cislo/8-kavka.pdf [25 Oct 2015], 2012. (Original in Czech)

[10] CISKO Š. et al.: *Ekonomika podniku,* Žilina, Žilinská univerzita, 2013. (Original in Slovak)

[11] REPKOVÁ ŠTOFKOVÁ, K.: Využitie znalostného manažmentu na podporu konkurencieschopnosti, *Manažment a sieťové podnikanie vo vedomostnej ekonomike,* Žilina, Žilinská univerzita, pp. 7-24, 2013. (Original in Slovak)

Review process

Single-blind peer reviewed process by two reviewers.

CONDITIONS FOR IMPLEMENTING ORGANIZATIONAL CHANGES

Renata Winkler
Cracow University of Economics, Faculty of Management, Department of Organizational Behaviours, ul. Rakowicka 27, 31-510 Cracow, Poland, renata.winkler@uek.krakow.pl

Keywords: change management, resistance to change
Abstract: Changes are one of the most typical phenomena experienced by contemporary organizations and are an inherent element of their functioning. The change introduction process is complex and it is often accompanied by a phenomenon of resistance to change on the part of the employees in an organization, which is considered as the main cause of failure in the change implementation process. The purpose of the article is to discuss the basic conditions for implementing changes related both to their adequate defining and overcoming resistance to change.

1 Introduction

A necessary condition for survival of contemporary organizations is the development of adaptation abilities through internal transformations. Changes are thereby an integral element of functioning of an organization – lack, omission or interruption of changes prevent an organization from surviving. Furthermore, organizations during transformation often must reject everything which was effective for them in the past to survive. The need for introducing changes depends on both external conditions (necessity to face economic, qualitative, technological, ecological and social challenges) and internal conditions (maturing of an organization, evolution of its culture, increasing experience of people employed, changing employee attitudes). Changes may relate to strategic assumptions, procedures of internal structure, management methods and techniques, type of produced goods and provided services, manufacturing technology, reorganization of work environment, etc. The purpose of the paper is to discuss basic (nodal) conditions of implementing changes

2 ABC of the change process planning

A base for proper determining the extent and type of all necessary changes is defining the needs of a specified business entity. It requires an exact identification of problem areas existing in an organization. The situation should be assessed in a possibly holistic manner[1], to diagnose type, importance and causes of problems present in an organization. The more precisely defined problematic areas are the easier it is to adequately determine goal of changes (and thus, finally, results important for an organization) and the scopes of changes in their:

- objective aspect – i.e. issues to which changes will apply to (and what should be changed?)
- subjective aspect – i.e. which group of employees will be covered by the change process (whom changes will relate to?)
- time aspect – what are the time frames (when should changes take place?).

The determined goal of changes should be recorded in writing. At this point, it should be noted that, since organizations are open and poly-structural systems [1], achieving the goals set by organizations stimulates cooperation of their different subsystems. To achieve measurable effects, it would be then indicated that the process of changes, even when it solely refers to some part of an organization, should include linkages and connections between different aspects of the functioning of an organization as a whole[2].

Particularization of the outlined vision of changes after determining the goal and after defining their objective, subjective and time scope requires essentially:

- determining measures which, in the financial aspect, may be allocated for the needs of pursuing precisely defined expectations,
- determining who will comprise the team responsible for changes,
- preparing a schedule of changes (along with planning specific intermediate stages and way of measuring the achieved results in the change process).

Additionally, making any decisions or undertaking activities requires considering first of all three facts. Firstly, for objective reasons, the implementation of organizational changes must proceed simultaneously with normal operations of an organization.
Secondly, organizations are also social systems, and hence without the ability to mobilize employee energy, no

[1] For instance, it is worth analysing the structure of a given organization; type of services provided/assortment; quality of services/products; types of relationships between different units of an organization; type of processes implemented as part of it; direction of the course of processes; number and type of process participants; type of technologies used.

[2] After all, the practice shows that introducing changes in only one area of a company's operations normally brings small benefits.

change – no matter how spectacular – will be a sustainable change [2].

Thirdly, it is worth treating a change as a flexible process that can (and even should) be adjusted to the changing situation.

3 Resistance to change and methods of overcoming it

A natural reaction of people to a disturbance of the existing *status quo* is the phenomenon of *resistance to change*. In the opinion of H. Steinamann and G. Schreyögg [3], it means essentially *an emotional blockade* towards changes. Resistance as a type of mental condition (conscious or unconscious) may make employees both undertake moves making it impossible (hindering) to introduct and maintenan changes, and refrain from undertaking activities contributing to introducing changes in the event when these depend on the employees themselves. The first case shows active resistance and the second case shows passive resistance. Resistance to change may have a unit, group or even global form (including all the employed) and may be expressed, for instance, in open criticism of superiors, creation of resistance groups among employee teams, growth in fluctuation and absence indicators or reduced work efficiency. Sources of resistance are much diversified. Among the main reasons for its occurrence, the following are indicated [4]:

- lack of perceiving the sense of change by employees,
- uncertainty as to effects and/or reasons for changes,
- aware of weaknesses of the proposed changes,
- fear against loss of the appreciated values (a threat for own interests),
- feeling of imposing (forcing) a change

and

- a change program breaching an informal network of interpersonal relations.

Resistance appears thus whenever the employees have the feeling that changes fail to meet their core needs as [5]:

- safety,
- inclusion and connection,
- power,
- control,
- competence,
- justice and fairness.

The phenomenon of resistance should be neither combated (this may result in its escalation) nor underestimated in any case. Combating and/or underestimating resistance may involve significant in the scale of an organization costs both in the economic and social aspect. The process of overcoming /minimizing resistance plays a priority role in the change process management and should be conducted with observance of some rules of conduct worked out on the ground of socio-psychological sciences. In the opinion of S. Hornberger and P. Knauth [6], the best method of overcoming any barriers related to change implementation is:

1. informing,
2. communicating,
3. training.

Q 1. An information campaign conducted adequately early prevents gossips from spreading among an organization: those gossips, by providing distorted and/or false information, can significantly hinder introduction of the planned transformations. An information campaign should be targeted to a broad group of employees (optimally, it should cover all of the employed). Under this campaign, it is necessary to:

- explain the reasons for the need of implementing changes,
- determine goals3, benefits and risk related to change implementation,
- discuss the issues related to maintenance/reduction in the number of jobs in an organization.

The transferred information needs to be reliable (true), full (exhaustive), valid, arranged, clear (deprived of contradictory, mutually excluding or inconsistent content).

Q 2. Active, open and multidirectional communication (covering, among others, conversations, discussions, consultations, sessions of questions, working meetings, development and agreement of common positions, etc.) is considered as a reliable antidote against uncertainty related to changes. Although the communication itself does not eliminate resistance to change, it allows, however, reducing the degree of its intensity. Communicating is a process underlying any kind of effective interaction between individuals. Not only does it enable coordination of the taken activities, but also satisfies, in the pragmatic, cognitive and emotional aspect, current and prospective needs of interacting individuals. Quality of communication in an organization has, among others, effect on motivation of employees and their satisfaction with work. Lack of active communication impedes transfer of values and knowledge significant from the point of view of an organization. Creation of relevant "mental models" of employees, building agreement and community among them requires, first of all, involvement in active communication [7]. It is advised to use such communication techniques as: MBWA (manager by wandering about), briefings and working meetings, official messages, websites.

[3] The main goal and partial goals important from the point of view of achieving the main goal.

Q 3. Properly selected and delivered trainings for people affected by change help a change to rise because they lead to modification of the knowledge, skills and attitudes of the employees. Through trainings, it is possible to understand some phenomena and dependencies learn proper methods/schemes of procedure in certain situations and gain necessary knowledge under controlled "safe" conditions. It results in shaping in the trainees, firstly, a kind of openness to changes (development of adequate attitudes of the employees) and, secondly, some dispositions as to their likely behaviours with regard to specific situations (also situations new for them, because properly selected and delivered trainings prepare them for efficient functioning under new conditions related to change). Even in the case when, from the point of view of training participants, training does not bring new or original content, a change takes place due to finding, naming and arranging knowledge already held by the participants. Additionally, training may enable the personnel to develop.

In the process of introducing changes a significant importance is attained also to employee participation and properly shaped organizational culture.

Participation raises commitment and the so-called share of human factor; provided that, in order to overcome their aversion to change, employee activity must consist of three following factors: access to information, impact on decision-making and interaction [8]. Principles of active employee participation in making decisions related to changes (including: identification and determination of a problem, collection of information about problematic situations, creation of possible solutions, evaluation of alternatives, selection of solution), and cooperation during their introduction (both during implementation of decisions and evaluation of change implementation results) are regarded as "golden rules" of successful organizational changes [9]. It can be justified. Common planning of a change process and its implementation allows the employees to perceive the sense of changes and build a sense of personal control over situation (no feeling of compulsion among the employed). Furthermore, group action allows reducing the level of fear and increases the probability of eliminating/adjusting moves unfavourable from the point of view of the whole organization.

The organizational culture should be treated as a constituent element of the change process internal conditions [10]. It can be said that the sustainability of introduced changes is connected, first of all, with the degree of their rooting in the organizational culture. K.S. Cameron and R.E. Quin indicate, as causes of failure of a considerable part of programs of organizational transformation, forcing of changes incompatible with the organizational culture [11]. The organizational culture is characterized by a considerable degree of content rigidity and is not shaped easily. This does not mean, however, that it is impossible to conduct a conscious and controlled process of cultural transformation. Consequently, in the opinion of L. Clarce [12]: *"building a culture that would match a dynamic and variable market is one of new organizational challenges. This is, however, a process laborious, long lasting and requiring commitment of both employees and management of an organization".*

Conclusions

For a transformation to be successful, of which changes are to be support, the process of changes should be adequately prepared. It is necessary to take care of such issues as: evaluation of the need for a change by an analysis of problematic scopes in an organization, preparation of a change vision with a corresponding schedule (including planning of specific intermediate stages), appointment of a team responsible for change implementation, measurement of the results achieved in the process of changes and reinforcement of the new approach. It is particularly important to pursue those actions in a manner contributing to minimizing (overcoming) the phenomenon of resistance to change. Therefore pursuing organizational changes requires a planned and complex communicating of changes to people, building of open communication, acquisition and involving employees in the process of changes and building of an organizational culture in which the postulated above elements are deeply embedded.

Acknowledgement
The publication was financed from the funds granted to the Faculty of Management of the Cracow University of Economics, within the framework of the subsidy for the maintenance of research potential in 2015.

References

[1] KRUPSKI, R.: Systemowa koncepcja organizacji i zarządzania, [in:] Zarządzanie przedsiębiorstwem przyszłości. Koncepcje, modele, metody, (ed.) Perechuda, K.,. Agencja Wydawnicza Placet, Warszawa, p. 13, 2000. (Orginal in Polish)
[2] CLARKE L.: Zarządzanie zmianą, Gebethner&Ska, Warszawa, pp.219–220, 1997.
[3] STEINAMANN, H., SCHREYÖGG, G.: Zarządzanie. Podstawy kierowania przedsiębiorstwem. Koncepcje, funkcje, przykłady, Oficyna Wydawnicza Politechniki Wrocławskiej, Wrocław 1998, pp. 302-303, 1998.
[4] ANDERSON, A.H.: Effective Personnel Management – a Skills and activity–based Approach, Blackwell, Oxford–Cambridge 1994, p. 184, 1994.
[5] ANDERSON, D., ACKERMAN-ANDERSON, L.: Beyond Change Management. How to achieve breakthrough results through conscious change leadership, Pfeiffer, San Francisco 2010, p. 18, 2010.

[6] HORNBERGER, S., KNAUTH, P.: Einführung flexiber Arbeitzeitmodelle. Die Wiederstände, "IO Management" 2000, No. 7/8. p. 53, 2000. (Orginal in Deutch)
[7] SENGE, P.M.: Piąta dyscyplina, Oficyna Ekonomiczna, Kraków 2002, p. 203 and p. 218, 2002.
[8] WEST M.A.: Rozwijanie kreatywności wewnątrz organizacji, PWN, Warszawa 2000, p. 64, 2000. (Orginal in Polish)
[9] STEINAMANN, H., SCHREYÖGG, G.: Zarządzanie. Podstawy kierowania przedsiębiorstwem. Koncepcje, funkcje, przykłady, Oficyna Wydawnicza Politechniki Wrocławskiej, Wrocław 1998, p. 303, 1998.
[10] CZARNOTA, J.L.: Zarządzanie jako czynnik restrukturyzacji przedsiębiorstwa, „Przegląd Organizacji" 1999, No. 1, p. 19, 1999. (Orginal in Polish)
[11] CAMERON, K.S., QUINN, R.E.: Kultura organizacyjna – diagnoza i zmiana, Oficyna Ekonomiczna, Kraków 2003, p. 11, 2003.
[12] CLARKE L.: Zarządzanie zmianą, Gebethner&Ska, Warszawa, pp. 52-53, 1997.

Review process

Single-blind peer reviewed process by two reviewers.

JOURNAL STATEMENT

Journal name:	**Acta logistica**
Abbreviated key title:	Acta logist
Journal title initials:	AL
Journal doi:	10.22306/al
ISSN:	1339-5629
Start year:	2014
The first publishing:	March 2014
Issue publishing:	Quarterly
Publishing form:	On-line electronic publishing
Availability of articles:	Open Access Journal
Journal license:	CC BY-NC
Publication ethics:	COPE, ELSEVIER Publishing Ethics
Plagiarism check:	Worldwide originality control system
Peer review process:	Single-blind review at least two reviewers
Language:	English
Journal e-mail:	**info@actalogistica.eu**

The journal focuses mainly for the original and new, interesting, high-quality, theoretical, practical and application-oriented contributions to the field of science and research as well as to pedagogy and education in the field of logistics and transport.

Publisher:	**4S go, s.r.o.**
Address:	Semsa 24, 044 21 Semsa, Slovak Republic, EU
Phone:	+421 948 366 110
Publisher e-mail:	**info@4sgo.eu**

Responsibility for the content of a manuscript rests upon the authors and not upon the editors or the publisher.