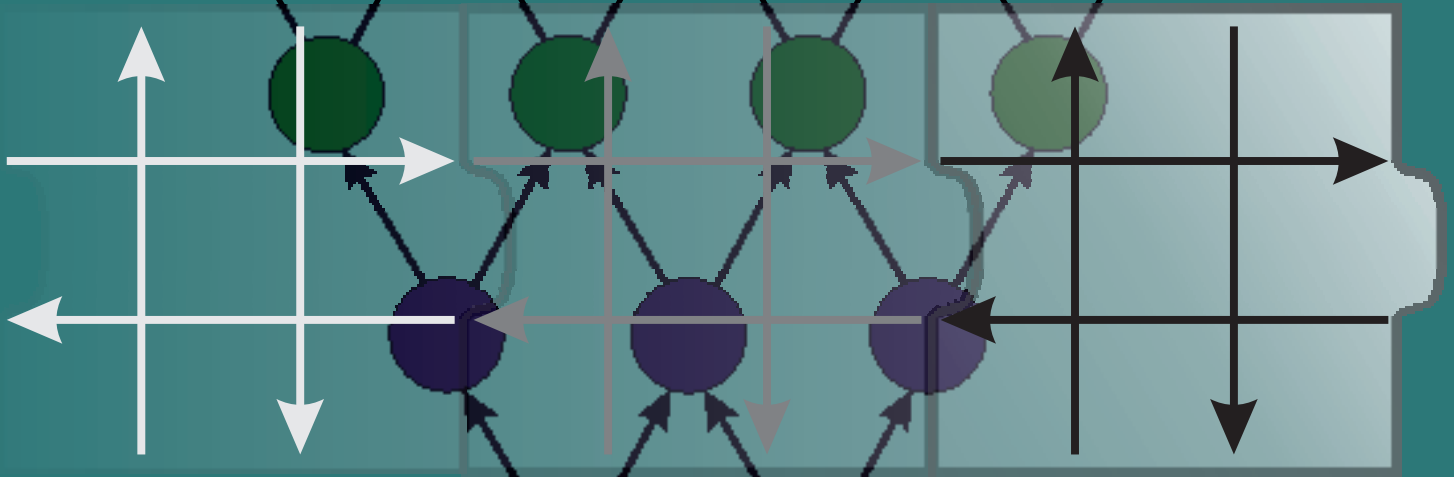
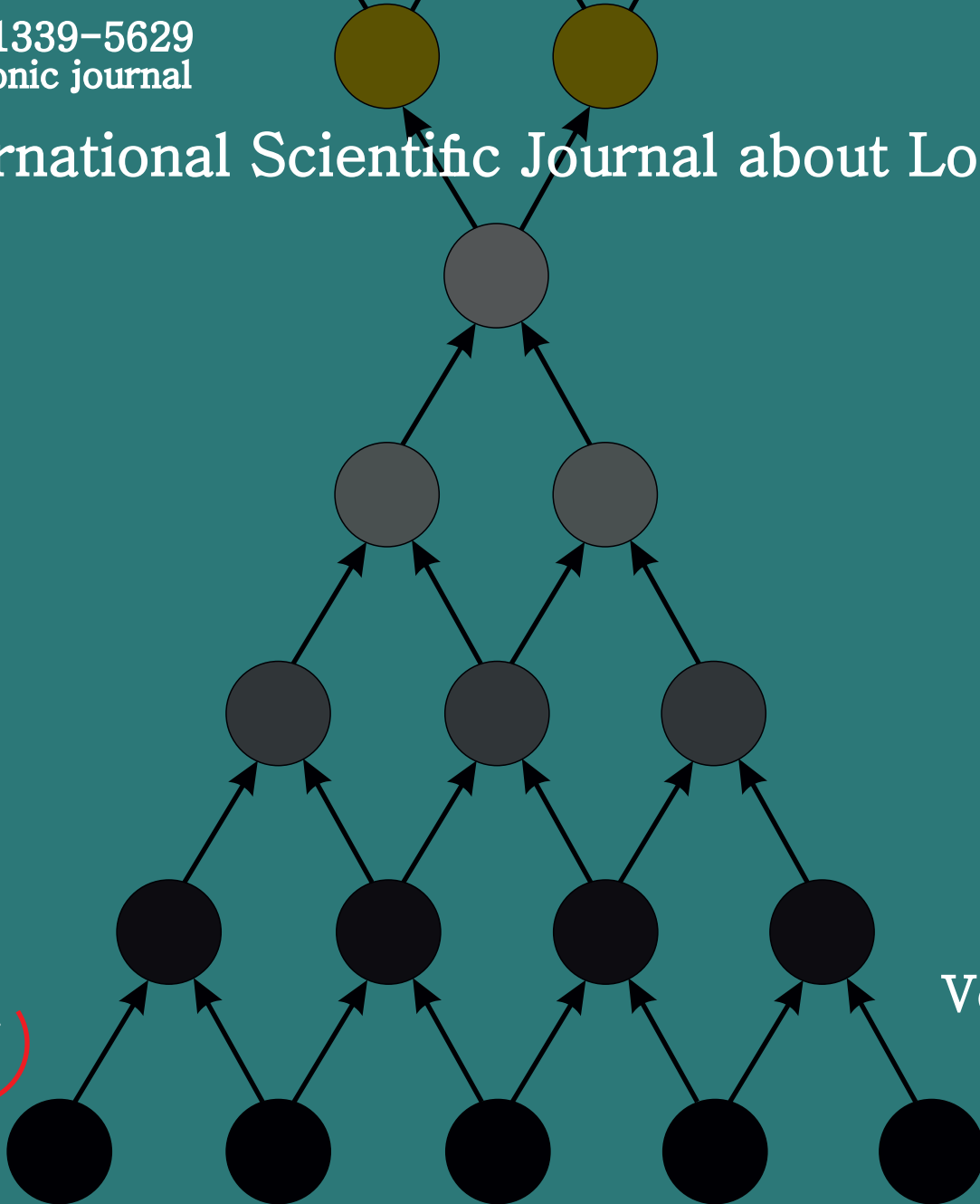


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Keywords: RFID technology, railway wagon, maintenance management

Abstract: Automated data collection helps to improve the precision of decision-making processes. Currently, the radio frequency identification technology belongs to the most common application in the field of identification technology. In the world, the implementation of RFID technology is used in almost all areas of industry. RFID tags allow to use of the different products and materials applications. The article provides an overview of using this technology to record and register maintenance intervals of railway wagons. The application of RFID technology helps to avoid huge disasters and accidents caused by lack of information about the technical state of rail freight wagons.

1 Introduction

RFID technology uses radio waves for automatic identification and tracking objects to where the RFID tag is applied. RFID tags has stored various information necessary for the user and using a reader which transfers informations to the system [1, 2]. This aspect has a direct impact on the reduction of the human factor in the decision making processes and implementation of necessary jobs for technical checks of the condition of freight wagons and realise preventive inspections. RFID technology allows continuous monitoring of selected data and can point out, for example, the date of preventive examinations and other roadworthiness [3].

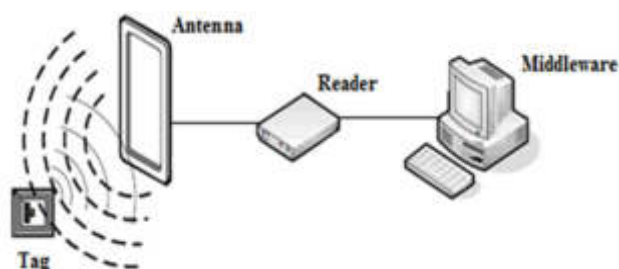


Figure 1 The components of the RFID technology

2 The current state of the maintenance of rail freight wagons

The main problem of rail freight is the failure of wagons used for this transport. Bad technical condition is caused by improper handling of the wagons during the period of operation. Every single

part of the wagon is influenced by other parts of the system and its surroundings during the period of use. These disorders cause the cars are excluded from the operation. Maintenance, care and repair of rolling stock are scheduled periodically or preventive. Unscheduled repairs occurs only if the failure is detected. When wagons operate, each of the loading stations perform accurate technical inspection activities, if a problem is found with any part of the wagon, the wagon has to be taken out of operation and transported to the nearest repair station. For the technical condition of wagons during the operation depend to employees responsible to do this technical control. If an error occurs, freight wagon that fault may result in malfunction or damage to other functional parts of the wagon. This can cause tragic consequence such as derailment of the trainset.

2.1 The consequences of inconvenient technical condition of wagons.

Consequences of that accidents are significant, except for the economic losses resulting from impassable transport hub (lost profits, penalties for late payment). There are also the material losses such as damage their rail freight wagons, rail switches, or the environment in the immediate vicinity of the accident. Sometimes it brings loss of life, as in the recent case, which has become on July 6, 2013 in Lac Mégantic in Canada (Figure 2), which was derailing train set [6]. This train was carrying dirty oil in tanks. The accident was caused by brake failure caused by air leakage in a derailment occurred explosions of five tanks and

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then the destruction of more than 30 buildings in the area where the explosion killed 42 people. Another example will be represented in the next accident. This train accident became on June 29, 2009, in Viareggio, Italy (Figure 3). The explosion occurred tankers carrying liquefied petroleum gas and killing 32 people [7]. The accident was caused by poor technical condition of the brakes and gearing. As indicated above, frequently the cause of such accidents due to bad technical conditions and in particular the wear of the brake system and components.



Figure 2 The accident in Lac-Mégantic [6]



Figure 3 The accident in Viareggio[7]

3 The current state of recording technical inspections

The registration of these technical inspections is based on direct entering the informations as to preformed place which is located on the right side of the wagon. The records include:

- Nb - date of lubrication of the brake system
- M - date of bearing lubrication chamber lubrication

- EVIC - date of visual inspection of the wagon wheelset axle

Location of these technical inspections, in the first column of the table shown in the figure 4.



Figure 4 The current state of recording technical inspections

The main disadvantage of the current registration of technical controls is related to the human factor. Consequences arising from the adverse impacts of human error can be eliminated by the application of the technologies of automatic identification. However, the proposal was chosen as applicable RFID technology.

4 Design of an application RFID tags as a replacement for the currently used method of keeping the service controls

RFID technology can be used for gathering all the information on the freight wagon. It is necessary to apply RFID tags resistant to the external environment. The rank of the tags is apparent from the standardized location reading device and on the left side plate in height of 1200 mm (Figure 5).

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Figure 5 Proposal for placement RFID Tag

In memory of the RFID tag will be stored information about the complete technical condition of the wagon about repairs and when they were done. The next periodic technical inspection and records of extraordinary repairs. The collection of this information will provide not only a complete overview of the technical condition of the rail freight wagons, but can summarily quantify the costs associated with servicing and operation of rail freight wagons. In addition to the technical inspection intervals RFID technology provides space for the complete collection of information on the wagon (identification interoperability, state code, custom wagon number, check digit can identify the sender, recipient and payer type of goods, the total weight) [4].

This application provides the possibility of direct connection RFID technology with enterprise information system of rail freight transport (Figure 6). For these applications, it would be appropriate to use two configurations of readers. Mobile readers should be used mainly for local operating wagons where the individual stations make changes of the information stored in the RFID tag as adjustments in the composition of the train or vehicle documents. Stationary sensors should be placed at the entrance and exit from the station [5].

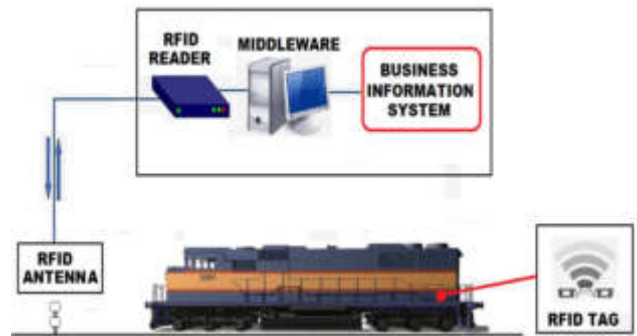


Figure 6 The scheme of the proposed application in conjunction with Business Information System

Conclusion

The biggest advantage of RFID applications can be reduction of accidents and improve the information flow. Based on the automated registration of technical condition, it can exclude wagons from the transport, which have already expired particular technical controls, respectively, in advance and in a timely schedule of this inspection. On this basis it is possible to eliminate situations that could arise from the bad technical condition of the wagon. The aim is to build a functional and modern network information flow and data collection to be used by operators of railway lines and reducing the number of accidents caused by the use of rail freight wagons in bad technical condition.

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SIMULATION AS PART OF INDUSTRIAL PRACTICE

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Keywords: simulation, model, program, system, production**Abstract:** Article discusses the simulation as an efficient scientific method of problem solving in industrial practice. It creates an overview of the simulation program means used in industrial practice and creates an overview of tools for discrete, continuous, and combined.**1 Introduction**

The basic principle of simulation is based on a simplified representation of the real system. Simulation model describes only the major properties of the real system. After verifying the validity and verification of the simulation model is implemented a set of simulation experiments. In experiments are proposed various improvements of simulated system and is determined their impact on the modelled system. To improve properties of the real system is chosen and applied the best variant obtained from simulation. Simulation not obtain direct optimal solution, it is a support tool for testing different variants and obtain the impact of decisions on the real system. When evaluating the results of the simulation to be aware of it that results of simulation are probably values [1], [2].

2 Properties of the simulation model

An important property of the simulation model is that it must have the same configuration changes over time. That mean, that all activities that are carried out in a particular desired order should be maintained also in the creation of a model for the simulation [3], [4].

The model for computer simulation becomes at the final form a computer program, which should capture the structure of the modelled system, its dynamics and its probabilistic nature [6], [7].

The advantage of simulation before experimentation with real system is mainly that is much cheaper, more flexible, safety, does not affect the ongoing production process. Simulation also has some disadvantages which are related to a description of the main problems with decision

rules, quantification of variables, selection boundaries and limits of the system, etc.

Classification of models

Models it is possible to classify and sort by many criteria. One of the primary classification is broken by the means used to define them. The image (Figure 1) is a detailed breakdown of models that pursues the branch leading to the simulation and optimization models.

That division of model is only one of many possible. It should be noted that the breakdown at lower levels can be repeated. Dynamic model which belong under the mathematical model does not automatically mean that every dynamic models must be also mathematical model.

The phases of the simulation process are [5], [8]:

1. Definition object of knowledge, definition, selection subjects from the environment, resp. determined requirements for object,
2. Definition simulated system of object, determination of the level from which the object is observed and studied,
3. Creation of the current ideas about the simulated system and its motion, i.e., formulation of hypotheses of object, resp. processing of system design and identification of used subsystems,
4. Creation of a simulation model, design and implementation of the model,
5. Verify the accuracy of the simulation model, verify that the model represents the current vision of the simulated system and its motion,
6. Verify the veracity of the simulation model, verify whether designing the system meets the

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defined requirements and can be practical implemented.

7. Exploitation validated simulation model for forecasting, optimization of projected.

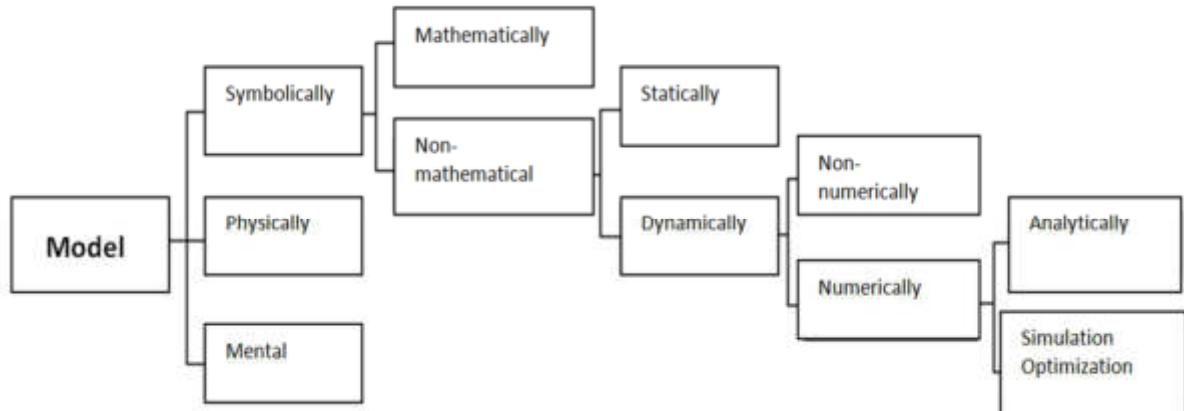


Figure 1 Classification of models

Further is processed brief overview of the tools that can be used for simulation. Since the object of interest is the only computer simulation, this report includes only means of simulation software. The creators of computer simulation models have three alternatives program funds [2], [9].

3 Languages

1) General programming languages

General programming languages today are a vast number. The best known of these include C, C ++, Java, C #, Pascal, Fortran, and others. Their big advantage is flexibility. Experienced programmer with their help is able to create any model of any structure and behaviour. The disadvantage, however, is the difficulty of programming. Virtually none of them offers any pre-built means for creating simulation modules. Their use is therefore very time-consuming and the outcome is uncertain. Currently they are used minimally.

2) Simulation programming languages

Simulation programming languages have evolved from general programming languages supplementing them with structure and appropriate means for creating simulation models [10], [11]. It can be quite misleading to label this group as "programming languages".

Most of these products are in the form of Visual Interactive Modelling System (VIMS) and their appearance and way of operating is so much more akin to a category of computer games as a programming language. This name is historically affected, because in the beginning were actually programming languages. Even today, most of these tools have opportunity to interface with general

programming languages or have simulation language as an integral part. A significant disadvantage of these products is their price, which reaches thousands of euros.

Although the impact of general programming languages for developing simulation programming languages is predominant, one can also find the opposite effect. E.g. simulation programming language SIMUL first introduced programming of object and management by events. This technique has been two decades later received in the general programming languages and still prevails in the approach to programming.

3) Other languages and programs

For some types of simulation tasks, it is possible to use other languages and programs [12], [15]. This may be due to their ease of use and price. As an example may serve tasks, that can be solved by Monte Carlo method in MS Excel spread sheet. There are other extensions to these spread sheets such as RISK from company Palisade for risk analysis. A separate spread sheet is Crystal Ball created by Oracle, which is a general tool suitable for predictive modelling, forecasting, Monte Carlo simulation and optimization.

Another example of these resources is various mathematical and technical computing systems such as MATLAB and SIMULINK from a MathWorks. This however at present it offers many simulation possibilities that it can be included in the first group above simulation languages.

4 Tools of Simulation

Simulation may divide to by nature of changes in the model [5], [13], [14]:

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- discrete, discontinuous - examines the state of the system in discrete, discontinuous time intervals, intervals can be defined by the time at which some change of the system or event happens, use: manufacturing, services, business processes, complex systems,
- continuous - examines the state of the system continuously, depending on the model simulation is divided into: deterministic, stochastic - deterministic simulation results is determined at the time t_0 , stochastic results is determined in probability, use: biology, chemistry, control systems, economics, electronics,
- combined.

Tools for discrete simulation:

- ARENA from Rockwell Automation is a general simulation language especially for industrial applications and business process reengineering. It is part of the larger groups of ARENA to support management decision-making. In the simplest basic version only supports discrete simulation, but higher versions also support continuous and combined simulation.
- SLX, GPSS / H from Wolverine Software Corporation. These are two separate products. Both are general simulation tools for discrete simulation. GPSS is the oldest simulation languages at all. SLX is a newer product that extends the capabilities of GPSS (such as hierarchical building of model, object-based approach, new modules etc.).
- PROMODEL from a Promodel Corporation. It is designed for assessment, planning and design of production, storage, logistics and other operational and strategic needs.

From the same company has also produced other simulation products that focus on a specific area utilization:

- MEDMODEL is designed for simulation in healthcare.
- Service MODEL designed for the area of services.
- Clinical Trials Simulator to simulate clinical trials.
- Portfolio Simulator for analysis and portfolio optimization.
- Project Simulator for creating scenarios in Microsoft Project.
- Process Simulator which enables us to carry out simulations in Microsoft Visio.
- ED Simulator the field of medical emergency services.
- SIMPROCESS the company CACI Products Company. It is designed to simulate business processes. Integrates mapping process, discrete simulation and activity-based costing.

- SIMSCRIPT III by these companies CACI Products Company. It is an object-oriented simulation language for discrete and continuous simulation models. It is intended for programmers.
- SIMUL8 from a SIMUL8 Corporation. It is intended primarily for business process modeling.
- WITNESS from the Lanner Group. It is intended primarily for simulation and optimization of production, set of service and logistics systems. The program comes in two versions: Manufacturing Performance Edition for simulation of manufacturing processes and the Service and Process Performance Edition for the area of services. These variants are functionally identical, the difference lies only in different terminology, and another set of pre-built components. Additional expansion accessories include for example Witness Visio, which enables interconnect Witness with Microsoft Visio product.

Tools for continuous simulation

- STELLA from a ISEE Systems. It is intended for simulation of natural and social areas.

Tools for combined simulation

- ARENA from Rockwell Automation.
- EXTENDS from the company Imagine That - it allows continuous simulation, discrete event simulation, agents, linear, nonlinear and mixed simulation of general processes.

Conclusion

Application of simulation as a scientific method, especially in manufacturing practice, represents efficiency and savings in the implementation of various projects. Using it are gathered knowledge and information on the investigational system and its elements, the behaviour of the system and outputs from simulated variants in a computerized form. Results of the simulation are then applied to a real system to improve its properties.

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A COMPARISON OF SUPPLIERS AND THEIR LEVELS WITHIN THE PURCHASING PROCESS

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Keywords: purchasing, supplier, evaluation, company

Abstract: Due to the effects of the global economic crisis, manufacturing companies have been forced to look for savings in all areas. Many manufacturing entities in recent years have not sufficiently optimized their purchasing processes. Effective and cost-optimised purchasing, however, is a crucial factor in a company's success. Assessing the quality of suppliers and their services therefore appears to be a key aspect. Deciding on which supplier to use is not easy, because there are multiple criteria that concern the complete marketing purchasing mix and other inner and outer factors that need to be taken into account. The final decision may have a significant impact not only on the entire manufacturing process, but also on the competitiveness of the respective product or the company as a whole.

1. Introduction

Purchasing is one of a company's key activities that in essence begins the transformation process. By the term purchasing, we mean all company business activities that aim to gain both tangible and intangible assets for a respective company. In a broader sense, purchasing can be characterised as a set of company activities related to establishment of the given company's need for material sources to perform its business functions and those activities associated with obtaining these sources, their transport, payment, distribution (such as stock management), inventory management and possible wear before their handover to production as well as inspections and lodging complaints about poor quality goods. [1]

2. The importance of purchasing within a company

This set of activities thus secures the materials required to initiate the manufacturing process within a given quantity, time and quality. The pivotal bearer of the purchasing function in every company is in most cases the purchasing department. As in every other area, the proper functioning of such department depends on suitably chosen and precisely defined assigned tasks, on the delegation of powers and on defining how to manage internal and external relationships. Economic stimulation of the whole department as well as individual workers remains a key aspect here. [2, 3]

Purchasing in its essence provides all feedstock for the manufacturing process. When the feedstock is acquired under poor (high) prices or a failure in shipment occurs, the entire manufacturing process can be adversely affected. Ultimately, this could lead to a danger of not

meeting the needs of the customer or even losing them. The purchasing process can thus significantly affect a company's competitiveness.

3. Supplier Evaluation

Selecting and evaluating suppliers can occur in different ways. Most of them, however, are based on monitoring pre-defined criteria. These may be related to price, quality, delivery times, delivery conditions and many other factors. However, only those criteria that are significant to the respective company are mostly looked at in these evaluations. Businesses prefer those that are related to the company's economic and business results (price, cost and quality). The volume of a purchase from a respective supplier (the actual size of the purchase) is naturally significant. Previous experience with the given supplier is thus often incorporated into the evaluations. In general, we can classify all potential criteria into the following four groups:

- criteria related to the product,
- criteria related to provided services,
- criteria concerning the price and contractual terms,
- criteria that evaluate the supplier's attitude and behaviour [4].

It is often better to secure a purchase from multiple sources in order to eliminate the dependence on a single supplier, which in addition allows for the possibility to conduct a comparison. This possibility is also used by companies operating in automotive production and related processes. Organisations always work with a number of long-term proven suppliers. In the case of repeated purchases, it is recommended to re-evaluate the selection

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of a supplier based on updated information, supplemented by a comparison of new purchase options and experiences. During the purchase decision-making, it is useful to distinguish between two groups of suppliers. The first group consists of smaller, regional suppliers. Even smaller contracts could be useful for these subjects. These suppliers try with the utmost effort to meet the agreed-upon orders because they do not want to lose a customer or to lose credit with the other potential partners. The second group consists of major suppliers that are able to deliver, often promptly, a fairly wide range of products. These suppliers, however, sometimes expect a higher level of activity from the buyer or concessions in qualitative parameters.

When deciding upon a supplier, companies should proceed so that the (according the availability of information and the severity of purchasing decision-making) final decision will be the result of:

- an expert assessment by a team or an individual,
- a rating evaluation (simple or with valuation - weighing - of the significance of individual criteria),
- a consideration of the results of calculating factors that can be directly quantified and an indirect quantification of quantitative characteristics (through a rating or an expert assessment),
- a combination of previous approaches [5, 6].

We often encounter difficulties when selecting and evaluating suppliers [7]. This may be due to the number of possible criteria. The actual evaluation can be based on the use of dozens of different criteria, such as in the automotive industry. [8] In the case of evaluating several suppliers, the process is even more complex (Figure 1).

Criteria	Value	Supplier 1	Supplier 2	Supplier 3	Supplier 4
K1 - Quality	20%	*	*	*	*
K2 - Price	10%	*	*	*	*
K3 - Delivery required quantity	5%	*	*	*	*
K4 - Provided services	10%	*	*	*	*
K5 - Reputation of the company	10%	*	*	*	*
K6 - Production capacity	15%	*	*	*	*
.....
		Σ ... Evaluating - order suppliers			

Figure 1 The multi-criterion character of supplier evaluation

Businesses often use a number of criteria when evaluating supplier subjects. Individual criteria then naturally have different meanings and significance. It is necessary to evaluate the significance and importance of the individual criteria. Many subjects have these weights

adjusted rather intuitively. Applying methods that help to reduce the intuitive character of the importance of evaluating individual criteria seems to be very appropriate here. An interesting option is the pairwise comparison method. This method uses a binomial comparison of all the monitored criteria. The criterion that is most important to the respondent is always identified with using this comparison.

Overall, the most important criterion is thus the criterion with the highest number of preferences. Preferences are considered non-normed weights which must be subsequently converted into normed weights. However, it can occur that a particular criterion has zero preference, which would mean it has zero importance. The nature of deciding on criteria, however, clearly shows that each selected criterion has a certain amount of importance. In this case, an additional consideration of obtained preferences is performed.

Calculating weights (1) is carried out using the following equation:

$$v_i = \frac{n+1-p_i}{n(n+1)/2} \quad (1)$$

n – the total number of criteria,
 p_i – the order of each criteria by number of gained preferences.

An example of the pairwise comparison method can be demonstrated on weight assigning for five selected criteria for an industrial company. The purchasing department has set the following five criteria for which it wants to use of the supplier evaluation:

Criterion No.1 – The amount of material placed in a consignment warehouse.

Criterion No. 2 – Discounts.

Criterion No. 3 - The speed of stock replenishing in the consignment warehouse.

Criterion No. 4 - The reliability of communication with the supplier.

Criterion No. 5 - The quality of raw materials and services.

The goal is to assess the weight and importance of each individual criterion. One hundred points must be distributed between the five monitored criteria, according to their importance for the company. During the first step, all the criteria are compared against each other (the left part of Table 1). In this way, all the possible criteria combinations are compared. The results of each evaluation are tabulated. The investigator always decides between two criteria and writes in the table the one that he/she considers more important (e.g. comparing K1 and K2). Using this procedure, he/she is able to compare all pairs of individual criteria (Table 1).

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Table 1. Weight assessment using the pairwise comparison method

K1	K2	K3	K4	K5	K _i	P _{pi}	P _i	V _i
	1	1	1	1	K1	4	1	0.33
		2	2	2	K2	3	2	0.27
			3	3	K3	2	3	0.20
				5	K4	1	4	0.07
					K5	0	5	0.13

The number of preferences P_{pi} is set for each criterion. This number represents the number of obtained votes. According to obtained preferences, the individual criteria are ranked (P_i). Using equation No. 2, the weights for individual criteria are identified (V_i).

$$V_i = \frac{n+1-p_i}{n(n+1)/2} \tag{2}$$

$$V_{i2} = \frac{5+1-2}{5(5+1)/2} = 0,27 \tag{3}$$

The calculation example for weight determination for criterion 2 is shown in equation (3). Weights for the other criteria were identified in the same way. Weights for all criteria were as follows:

K1 – The amount of raw material placed in the consignment warehouse – 0,33 - 33%.

K2 – Discounts – 0,27 - 27%.

K3 – The speed of stock replenishing in the consignment warehouse – 0,20 - 20%.

K4 - The reliability of communication with the supplier – 0,07 - 7%.

K5 - The quality of materials and services – 0,13 - 13 %.

The number of criteria can be arbitrary and the procedure for determining their weight is similar. The greatest advantage of this method is the fact that determined weights are based on a pairwise decision. The respondent determines the weights using his/her preferences. Determined weights can be thus used during the supplier evaluation.

Let's assume a company uses the criteria mentioned above when making their evaluation. These then have the following units and minimal and maximal boundaries:

K1 – The amount of raw material placed in the consignment warehouse (tons).

K2 – Discounts (1 to 5; 1 – Significant, 5 – None).

K3 – The speed of stock replenishing in the consignment warehouse (hours).

K4 – The reliability of communication with the supplier (1 to 5; 1 – Excellent, 5 – Poor).

K5 - The quality of materials and services (1 to 5; 1 – Excellent, 5 – Poor).

The following values are set for the above criteria (Table 2) for four model suppliers (D1 – D4). Each supplier is evaluated with regard to their level of quality based on all five monitored criteria. To determine which supplier is the best according to the current values, we can use the distance from fictive variant method.

Table 2. Values of individual criteria for monitored suppliers

Criteria	EVALUATED SUPPLIERS			
	D1	D2	D3	D4
K1	90,000	50,000	22,000	49,000
K2	2	3	4	1
K3	50	60	15	40
K4	3	2	1	4
K5	1	2	3	4

The principle of this method consists of quantifying the potential distance from the optimal variant. This method allows decision makers to also take into account criteria values, not just the ranking of suppliers in the respective area. Calculating the distance of fictive variant is shown in equation 4.

$$D_j = \sqrt{\sum_{i=1}^n v_i \times \left(\frac{x_i^* - x_{ij}}{x_i^* - x_i^0} \right)^2} \tag{4}$$

n . . . the total number of criteria

x_{ij} . . . the value of each criterion in terms of individual variants

x^{*i} . . . the best consequence due to criterion i

x⁰ⁱ . . . the worst consequence due to criterion i

The equation for calculating the distance from fictive variant takes into account the weight of the individual criterion and the best and worst values. Calculating individual distances is performed for all variants. The total sum of the distances of each criterion determines the value of the distance from the fictive variant. The smaller this value, the more profitable the given variant (supplier).

Table 3. Determining the distance from the fictive variant

Criteri on	v _i	x _i [*]	x _i ⁰	d _{ji}			
				D1	D2	D3	D4
K1	0.27	90,0	22,0	0	0.053	0.270	0.056
K2	0.33	1	4	0.037	0.147	0.330	0

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K3	0.20	15	60	0.121	0.200	0	0.061
K4	0.07	1	4	0.058	0.014	0	0.13
K5	0.13	1	4	0	0.008	0.031	0.07
			Σ	0.216	0.422	0.631	0.317
			D _j	0.465	0.650	0.794	0.563
			Rank	1	3	4	2

Table 3 shows the results of the supplier evaluation according to the monitored criteria. An example of the calculation (Criterion No. 1 / Supplier No. 2) follows:

$$d_i = v_i \left(\frac{x_i^* - x_{ij}}{x_i^* - x_i^0} \right)^2 = 0,27 \times \left(\frac{80.000 - 50.000}{90.000 - 22.000} \right)^2 = \underline{\underline{0,053}} \quad (5)$$

The d_{ij} value within Table 3 shows the distance from the optimal variant that can be considered fictive. According to the obtained results, it is evident that the best supplier is the one marked D1. For this supplier, the determined distance from the ideal variant is the shortest (0.465). The order of the other suppliers is as follows: D4, D2, and D3. With regard to the last place supplier (D3), it is shown that the determined distance from the optimal variant is almost twice as far as the distance identified with the first place supplier, D1. The determined distance from the fictive variant generally describes the “value” of the supplier and according to this value we can also quantify the actual differences between individual suppliers. The resulting order is therefore based on a quantification of all evaluated criteria.

4. Conclusions

The purchasing process can significantly affect a company's competitiveness. A key role is played here by the supplier evaluation. This can serve not only as an instrument for developing successful cooperation with suppliers, but can also be used a metric for evaluating them. When evaluating many potential suppliers according to a number of criteria, a company cannot simply rely on intuitive evaluations. The multi-criterion decision-making method that allows a company to evaluate their suppliers based on an exact set of factors is a very versatile instrument that can be used in any industry. The applied method of distance from fictive variant allows a user to assess any number of suppliers using a wide range of criteria. The method simultaneously also allows the user to quantify individual differences. A quality purchasing process can be a crucial factor in helping a company gain a competitive edge in the current challenging market conditions where even small differences influence the success of companies.

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BENEFICIAL COALITIONS: KNOWLEDGE MANAGEMENT AND DEVELOPMENT OF EMPLOYEE COMMITMENT

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ul. Rakowicka 27, 31-510 Cracow, Poland, renata.winkler@uek.krakow.pl**Marta Moczulska**University of Zielona Gora, Faculty of Economics And Management, Department of Human Resources Management in
Organisations, ul. Podgórna 50, 64-246 Zielona Góra, Poland, m.moczulska@wez.u.zgora.pl**Keywords:** knowledge management, employee commitment**Abstract:** Presently, knowledge is considered as the most strategic resource of organizations. The literature on the subject often raises the issues of commitment. The purpose of the article was to discuss the associations between knowledge management and employee commitment. The article presents the stages of knowledge management and describes the category of commitment, taking account of several criteria. In the opinion of the authors, from the point of view of knowledge management particular importance can be attained to the way qualifications, skills, predispositions and knowledge of employees will be used, which, in turn, depends on "quality" of their commitment (its type, intensity, dimension and direction) in achieving organizational goals.**1 Introduction**

At present, knowledge is considered as the most strategic resource of organizations. The publications with regard to management sciences devote much attention to the problem of knowledge management, in particular such issues as: knowledge development, knowledge codification, knowledge sharing, knowledge application or transfer. At the same time, in publications of this type it is also often emphasized that efficient functioning of economic entities, their innovativeness and adaptability to changes occurring in the external environment depend on the human factor. What is important, it is emphasized that the possibilities of improving actions inside the organization, increasing innovativeness of the company, or fulfilling customer needs better are determined not only by "characteristics" of employees (their qualifications, predispositions and knowledge), but the way these qualifications, skills, predispositions and knowledge will be used. Thus, growing interest in the issues of commitment, both on the part of management practitioners and theoreticians, does not arouse surprise. The purpose of the article is to discuss the associations between knowledge management and employee commitment.

2 Knowledge management process in the organization

Classically, quoting G. Probst, S. Raub and K. Romhardt, in the knowledge management process the following stages are distinguished [quot.: 1]:

- *Knowledge identification* – namely identification of sources of knowledge in the organization and in its

environment, along with the specification of content of these sources (i.e. importance of knowledge that can be obtained from them from the point of view of the organizational needs related to satisfying information needs and levelling competence gaps).

- *Knowledge acquisition* – namely obtaining specified knowledge resource (among others, from customers, suppliers, stakeholders, subcontractors).
- *Knowledge development* – namely development (creation) of new knowledge in the organization.
- *Knowledge distribution* – namely making available (transferring) knowledge to all employees who need it to perform their tasks in the organization.
- *Knowledge storage* – namely "retention" of knowledge in the organization to enable its future use, where necessary (development of organizational "memory").
- *Knowledge application* – namely use of knowledge in action.

Regardless of the way of our perception of knowledge (as a state of mind, object, process, set of conditions of access to information, or ability) it is - as "appurtenant" to the individual – unique. Knowledge is connected with the ability to use information, learn and gain experience in interpretation of information as well as in defining which information is necessary and what is its usefulness for the needs of making a specific decision. Therefore, the

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implementation of each stage of knowledge management requires employees to participate [2]. At the same time, it is worth emphasizing that findings of the research conducted by A. K. Gup and V. Govindarajan [3] indicated that the effectiveness of actions related to knowledge management:

- decreases along with decreasing tendency of the source to share knowledge,
- increases along with increasing value of knowledge in the recipient's opinion,
- increases along with increasing level of motivation of the recipient to acquire knowledge,
- increases with the application of various knowledge transfer channels,
- improves at larger possibilities of the recipient to absorb knowledge.

3 Employee commitment – theoretical perspective¹

As emphasized by B.L. Rich, J.A. LePine and E.R. Crawford, commitment is a multidimensional motivational construct that involves the simultaneous investment of an individual's complete and full self into the performance of a role [4]. When individuals are engaged they are investing their hands, head, and heart in their performance (ibidem). Commitment, among others, defines the extent to which employees identify themselves with the mission, values, goals of the company, performed tasks, exercised procession or social environment in which they are working [5].

Employee commitment can be characterized by various intensity. It is determined, among others, by the character of dependency between the employee and the company. The intensity of effort made by the employee will vary depending on whether or not the essence of the relation between the employee and the organization can be described more by [6]:

- "I must", when the employee does not have any alternative employment) (commitment type: Continuance),
- "I should", when the employee complies with some social standards and feels obliged in respect of the company to continue employment in it (commitment type: Normative)
- "I want" to be in the organization, when the employee is emotionally associated the company and any performed work (commitment type: Affective) – (Table 1).

¹ The words "involvement" and "engagement" are used as synonymous in this article.

Table 1 Matrix of satisfaction

Type of relation worker-organization	Commitment type	Commitment intensity	Made effort
"I must"	Continuance	low	For the purpose of achieving the required minimum
"I should"	Normative	average	For the purpose of doing good job (without value added)
"I want"	Affective	high	For the purpose of the organization (value added)

Source: own construction

From the practical point of view, it is important that essentially the higher the level of commitment, the higher the degree of employees who join in helping the organization and work better than required to maintain its position [7].

At this point, it is worth mentioning that: firstly, activity of employees constituting "a sign" of their commitment may have emotional, physical or intellectual dimension, secondly this activity can be focused on: pursuing goals of the company (direction in the organization), ways of performing daily tasks and obligations (direction: in work), actions taken in the scope of professional development direction in job) [8], or shaping relationships with superior and co-workers (in social environment).

4 Employee commitment and knowledge management

In the context of the discussed issues, it should be noted that "Continuance" type of commitment may threaten knowledge management. The employees who manifest it may not disclose information valuable for the organization. Also members of the organization, manifesting "Normative" commitment resulting from the sense of obligation (duty) – although they will share information, will select this information and restrict undertaken actions only to the specified requirements and some adopted principles. Only Affective type of commitment, as characterized by the desired intensity, resulting from the willingness of performing work in a given organization, triggers activity undertaken voluntarily by the employees, in the scope of their

competences and possibilities. It is worth anticipating factors having effect on promoting positive relations employee-company and, at the same time, the level of commitment.

On the other hand, each of the mentioned dimensions (emotional, intellectual, physical, which remain strongly interrelated), as well as "directions" of actions (to the: "organization", "job", "profession", "supervisor") being "a derivative of commitment" – may have a significant value for knowledge management (Table 2, Table 3, Table 4).

Table 2 Area of possible value added for knowledge management (part I)

Direction of commitment	I	IN THE ORGANIZATION		
		Physical	Intellectual	Emotional
Dimension of commitment	II			
Sign of commitment	III	<ul style="list-style-type: none"> - being a spokesperson of the company - initiating changes 	<ul style="list-style-type: none"> - focus on long-term employment (lack of interest in change of the job) - support for organizational policy - focus on organizational goals 	<ul style="list-style-type: none"> - pride in work in a given organization - identification with the organization - readiness for defending the company and its products
Consequence of commitment	IV	I voluntarily participate in activities fostering the organizational development	I opt for participation in the functioning of the organization	I want to accept (bear) responsibility
Area of possible value added for knowledge management	V	(Knowledge identification. Knowledge acquisition. Knowledge development. Knowledge distribution. Knowledge storage. Knowledge application)		

Source: own construction

Table 3 Area of possible value added for knowledge management (part II)

I	IN JOB			IN WORK		
	Physical	Intellectual	Emotional	Physical	Intellectual	Emotional
II						
III	<ul style="list-style-type: none"> - participation in trainings - developing skills, - initiating actively situations ensuring gaining experience 	<ul style="list-style-type: none"> - focus on being a specialist (professional), - understanding for the purpose of development 	<ul style="list-style-type: none"> - determination to succeed - passion 	<ul style="list-style-type: none"> - availability - demonstrating activity and initiative 	<ul style="list-style-type: none"> - understanding for additional obligations - consent to working in extra hours, if required by situation - focus on responsibility 	<ul style="list-style-type: none"> - pride in the performed scope of obligations - determination to overcome difficulties - readiness for devotions
IV	I learn, I share knowledge	I opt for expanding knowledge and developing passion	I want to develop	by taking care of quality I improve the way of performing tasks	I opt for caring about quality and results, I opt for undertaking effort related to looking for (developing) ways of raising quality	I want to prove myself (be appreciated)
V	(Knowledge identification. Knowledge acquisition. Knowledge development)			(Knowledge identification. Knowledge acquisition. Knowledge development. Knowledge application)		

Source: own construction

Table 4 Area of possible value added for knowledge management (part III)

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IN SOCIAL ENVIRONMENT	<i>Emotional</i>	- respect towards superiors and co-workers - trust in superiors and co-workers	I want to have good bonds /I want to work in the atmosphere of respect, trust and reciprocity/	<i>(Knowledge distribution. Knowledge application)</i>
	<i>Intellectual</i>	- focus on loyalty towards superiors and co-workers.	I opt for conscious relations building	
	<i>Physical</i>	- care for relations	I build relations based on trust and openness in communication	
	I	II	III	

Source: own construction

Conclusion

At the same time, it should be noted that effective knowledge management requires that the employee commitment be multidirectional (rather than unidirectional).

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APPLICATION OF LOGISTICS PRINCIPLES FOR THE PURPOSES OF INTEREST INCREASE IN THE SPIŠ REGION

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APPLICATION OF LOGISTICS PRINCIPLES FOR THE PURPOSES OF INTEREST INCREASE IN THE SPIŠ REGION**Dominika Szabóová**

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Keywords: services, logistics services, Spiš region**Abstract:** This article refers to the application of logistics principles for the purposes of interest increase in the Spiš region. The object of the research is the Spiš region, its structure and range of services. On the basis of system analysis results the recommendations were listed. Practical application of recommendations may increase the interest in the Spiš region and contribute to its development. Certain paragraph contains the time schedule and recommendation implementation costs. After practical application of selected recommendations their effectiveness was. Conclusions are contained in individual paragraph.**1 Introduction**

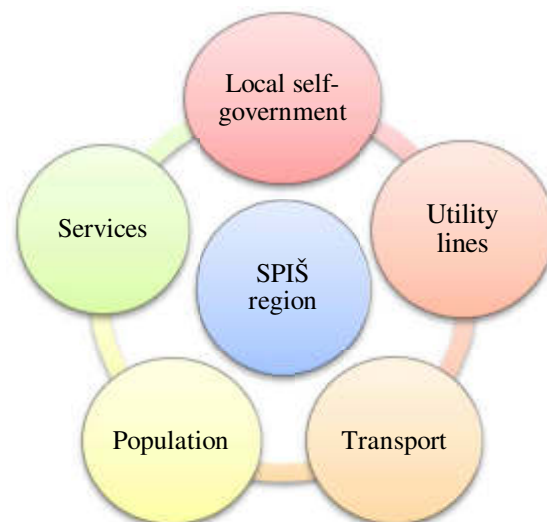
Logistics is a cross-cutting science which can be applied in various fields. Traditional logistics concept consisting of the management and implementation of material flows has been expanded by consideration that logistics also includes the transportation of intangible goods, i.e. services. Services as non-material character activities satisfy the needs of consumers. In order to satisfy the demand, it is necessary to ensure adequate services in the issued area; otherwise the decrease in interest can be caused. The object of research is the Spiš region. Through the range of services analysis in the region the deficiencies that reduce its attractiveness can be defined. Through the logistics services principle analysis, systemic activity can be created and can lead to interest increase in this region.

2 Method of analysis and synthesis

After examining the various research methods the systems analysis and synthesis were applied. System analysis should provide information necessary for the design of new solutions and synthesis. The result of synthesis should be new, more effective functioning logistics system based on an analysis of the original system or defined on the basis of the acquired theoretical knowledge [1]. The object of research was the Spiš region defined as a system of five components which are interconnected through ongoing flow of information, finance and goods (Figure 1).

Spiš region was divided into five subsystems. **Local self-government** consists of municipalities and higher territorial units. On the basis of regionalization of the Ministry of Economy of the Slovak Republic in 2005, the territory of the Spiš region consist of 4 districts with a total of 91 local self-governments - municipalities, 6 of them having the statute of the city [2]. **Utility lines** are on formed by gas distribution lines, electricity and sewerage system. **Transport** ensures the connection between self-

governments and also ensures the transfer of people and goods. **The population** is perceived as set of potential customers. Their interest leads to the expansion of offerings services. **Services** are a set of services that are provided in a given area and affect the quality of life of a resident population.

*Figure 1 System of the region Spiš***2.1 System analysis**

Through the system analysis the region was divided into individual local self-governments that were analysed independently in terms of community facilities and range of services which affect the residents' quality of life and represent the potential for future development. Part of the analysis was also a survey, which was performed with a sample of 472 respondents within the period of 8 months.

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2.1.1 The analysis of territorial units

The analysis of the Spiš region in terms of community facilities proved inadequate coverage of utility lines. According to the available results, gas distribution lines cover 75% of the territory, public water distribution system 81% and sewerage system only 43% of the region's territory. Railway lines lead just across the quarter of local self-governments and citizens must rely on the bus transportation because roads cover 100% of the territory. Medical care is provided only in district towns and some larger local self-government.

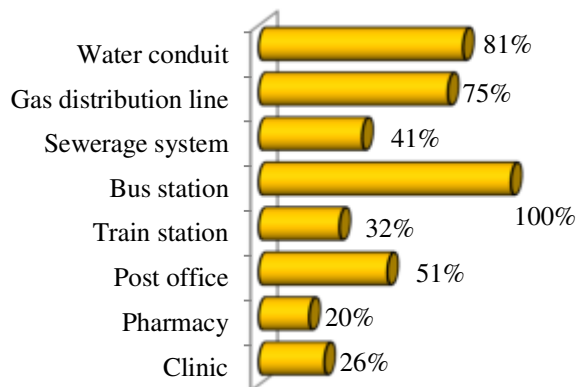


Figure 2 Utility lines in region Spiš

2.1.2 The analysis of range of services

In general, the range of services in the region Spiš is various. The offer of basic services (food shops, restaurants, gas stations) is complemented by special services (wellness, aqua park, museum), which can contribute to the development of villages, towns and region as a whole. Although in the cadastre of some self-local governments historical and technical monuments are located, there is no connection line between them and different segments of services.

2.1.3 The survey

The survey revealed that the biggest problem of the region is the lack of information that greatly affects the demand for services. Respondents' answers indicate a high rate of unawareness about region's attractiveness for the domestic population. Respondents have expressed a high level of dissatisfaction with the quality and availability of existing information system and tourist signs. According to foreign respondents the biggest problem is in the region language barrier and lack of information in a foreign language.

2.2 System synthesis

In general, the synthesis is the process of creating the new system. Technical aspects of designing are based on projects. Project can be understood as the allocation of resources aimed to achieve specific objectives with planned and organized approach [3]. Project is composed

of objectives, tasks, activities and deadlines. Setting a timetable for implementation of the proposed logistics system is the great importance attached to the planning. According to Kootnz and Weihrich (1996) the plan is sequence of activities suitably grouped to achieve the objective [4]. Correct built plan coordinates the efforts of all involved in the implementation of plan and also determines the direction, in which activities should evolve to reach the target [5].

3 Situation improvement suggestions

To eliminate deficiencies revealed by the analysis, principles of logistics and methods of planning were applied as well as decision-making and projecting with purpose of creating new logistics system. Lack of information can be solved by application of knowledge from the field of information logistics which is focuses to the management of the information flow.

3.1 The creation of web

Generally, the information flow is directly related for demand. According to Gúčík is: "The need for information increases together with the increasing distance from the target destination" [6]. This means that the amount of information which consumer requires about the object of his interest is directly proportional to the distance that separates the consumer and the object of his interest. The most widely used medium for information transfer is the information channel in the form of a website.

3.2 Geocaching in Spiš region

Another suggestion is to use the *geocaching* game as a tool of marketing to promote interesting (lesser known) locations in the region. Geocaching is a playful way to discover interesting locations by using GPS coordinates, suitable for all ages. The principle of the game consists of hiding *cache* in an interesting location and registration its position, indicating the GPS coordinates on official domain www.geocaching.com that serves as an information channel [7]. Players receive not only information but also an added value of experience associated with finding hidden *cache*.

3.3 Visiting of the interesting places Spiš

Least but no last suggestion to use the potential of region for its future development is creation of sightseeing tours that will connect interesting locations in the region with services with a focus on small businesses. There is no such a product on the domestic market and it represents the potential of the development for the region. Through the cooperation among partners material and information flow will be created, which is necessary for selling goods and further economic development.

This product will enable participating businesses to achieve higher profits by creating new demand in the

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non-competitive market much easier than rivalry with the competition in existing markets. This strategy is so called the *Blue Ocean Strategy*, which is based on the creation and use of space for new market demand. The strategy is primarily based on creativity and innovative approach in searching for new markets and opportunities and focuses on the ability to create a sovereign market space [8].

3.4 Further possibilities of region uniqueness usage

The region has a wide range of services. There is a lot of uniqueness, which may be interesting to the public. There are many alternatives to create an unique product which can satisfy demand of selected target groups of consumers. The main idea is to achieve the cooperation between organizations, businessmen and craftsmen, who could help to the development of the local economy and the market.

4 Price calculation of suggestions

To evaluate the feasibility of the suggestions costs were estimated and incurred in the implementation.

The average cost to set up a web site is between 30 – 40€. Some hosting companies, like *Websupport*, enable authors of different projects and interesting ideas to save part of the costs and then a possibility to avoid paying, i.e. 14 – 15 € per year. Thanks to this the installation costs will be reduced by 59%.

Start-up costs for a *cache* in *geocaching* game can be 2 – 5 €, depending on the complexity of design. *Cache* consists of a waterproof container containing a pencil and notebook.

The cost of implementation of the last suggestion, sightseeing tours leading through region by bus, will be different depending on the capacity, equipment of the bus, tour and additional services.

It can be assessed that all of the suggestions are feasible and do not require specialized equipment. For successful implementation cooperation between participants based on the outsourcing, under the direction and control of manager or organization, is required.

5 Suggestion implementation timetable

According to the general rules of projecting, suggestions require a timetable, which serves as a formal description of the time procedure of activities within the project and provides everyone involved with a comprehensive review of the project [9].

From the timetable it is obvious that the project has been divided into 7 implementation phases. The aim of the project is to increase interest in the region by using of logistics principles. Through the application of various tools of information logistics, methods of logistics planning and projecting of logistics systems, the following table presents few suggestions. Two of them was put into practice during the year 2015.

Table 1 The timetable for implementation of the project

Phase of the project	Orientation time of implementation
Phase 1 – Preparation of materials	
Analysis and survey	April 2014 – January 2015
Phase 2 – The first promotional activities	
Web page creation, search for partners	January 2015 – April 2015
Phase 3 – Stimulate the interest	
Promotion between population, businessmen	March 2015 – April 2015
Phase 4 – Maintaining interest and expanding circles of partners	
Maintaining interest, partners search	May 2015 – December 2015
Phase 5 – Evaluation of the success of project activities	
Reporting the success of the project activities	December 2015
Phase 6 – The implementation	
Establish a civil association	2016
Establish a network of partner organizations	2018
Offer cooperation for schools, travel agencies	2020
Plan and carry a field trip /sightseeing tour	2022
Phase 7 - Completion of the project	
Completion and evaluation of project	2024

The first five phases of the project were achieved in the planned time. During the duration of the project efforts were constantly exerted to maintain the interest by developing promotional activities. At the end of the year 2015 the evaluation of the success of project activities was performed. It will serve as a check on the progress.

The most important phase of the project, the implementation phase, has started in 2016. The priority of this year is to establish a civic association and create a network of partners. Aim of the project is the plan for sightseeing tour which should be fulfilled by 2022. The project will be evaluated and completed in the 2024.

6 Success evaluation of implemented suggestions

During the year 2015 two of the suggestions were realized: the creation of a web and the establishment of caches within the geocaching game.

6.1 The web and Facebook

For the establishment of domain, *www.kamnaspiši.sk*, the company *Websupport* was chosen, which provided the sponsorship to this project together with **Freeweb**. Thanks to this operating of domain costs is only 14.76 € per year. The website has been accessible to the general public in the Slovak language since April 2015. This website provides the consumer with information about an overview of the facilities, services of the region, events and its attractiveness. The main menu of the domain consists of 7 categories: parts of region, beauties of region, services in region, attractions, events and tip for the weekend.

Google Analytics was installed for better monitoring of operation of this site and number of visitors. This tool allows you to make various reports about visit rate, readership of articles and effectiveness of current advertising campaign [10].

From the records it is obvious, that the website after its publication in April 2015, has gained interest of public. In next few months was attended by 780 to 1,000 of internet users per month. Popularity significantly decreased in September 2015 to a level of 500 visits per month and this trend was maintained for the remainder of 2015. In January 2016 it can be observed a slight increase in interest of public over 600 visitors per month.

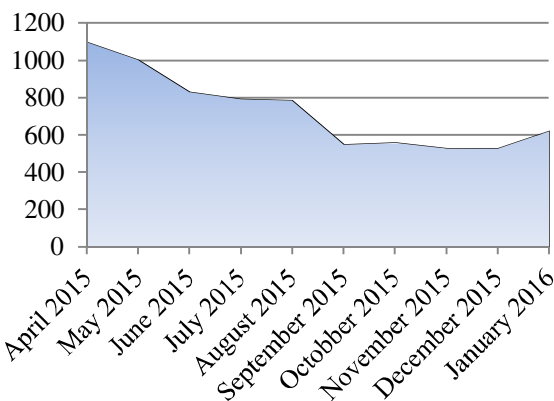


Figure 3 The number of visitors on domain *www.kamnaspiši.sk*

The analysis of visit rate demonstrates that returning visitors represent 17.40 % of all visitors and the remaining 82.60 % are new visitors.

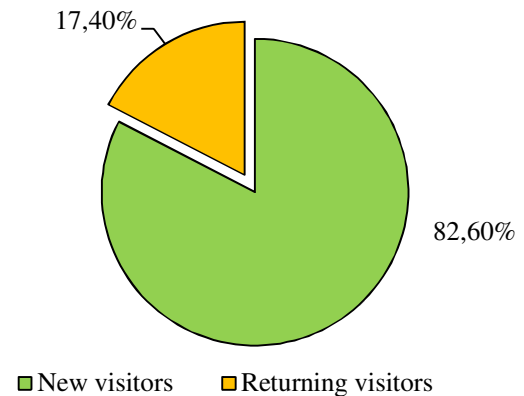


Figure 4 New visitors vs. returning visitors

According to records from *Google Analytics* 83% of all website visitors are residents of the region Košice and Prešov. According to available data, 60% of all visitors are residents of the district Spišská Nová Ves, visitors from Bratislava and the surrounding present 14%, from Košice and surrounding present 13%, inhabitants of Prešov and surrounding present 6% of and Poprad inhabitants represent 3% of total visits. Inhabitants from other county towns represent almost 1 % of all visitors. These figures point to the fact that website *www.kamnaspiši.sk* is known only in Spiš region, mostly in the district Spišská Nová Ves, but brand awareness is slowly spreading to other areas of Slovakia.

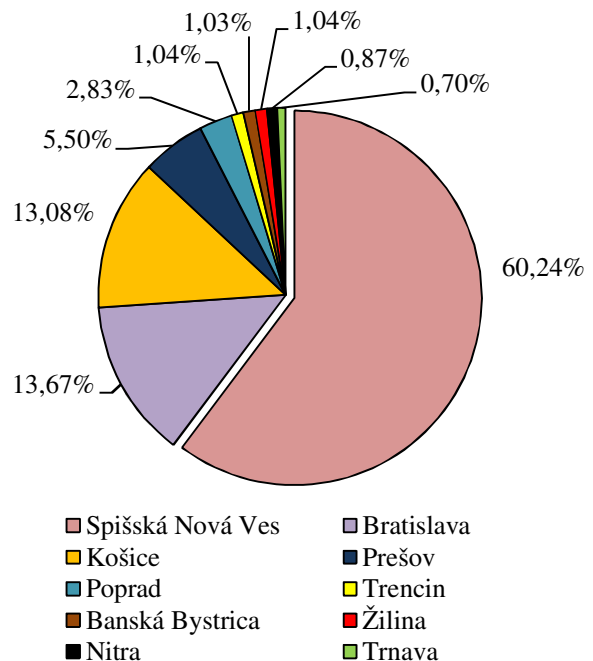


Figure 5 The visit rate according to permanent resident of visitors

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In order to raise awareness of this website www.kamnaspisi.sk were placed posters in region and created Facebook profile. During his nine-month existence gained more than 460 fans. Facebook is used as an information channel. Through social network can different users shared links to the various events and attractions of the region.

In October 2015 were extend marketing and promotion activities. Was closed cooperation with the administrator of local information portal www.snv.sk. Cooperation involves updating the calendar of events organized in the town Spišská Nová Ves on the domain www.snv.sk. In exchange, banner which presents the project *kamnaspiši* was placed on the domain www.snv.sk.



Figure 6 The banner of *Kam na Spiši*

Thanks to Google Analytics is possible to calculate, that 63% of all visitors discovered domain www.kamnaspisi.sk through social network Facebook. The domain www.snv.sk attracted 14% of visitors to *kamnaspiši* domain. The remaining 23% of visitors seek *kamnaspiši* domain directly or through other intermediate links. These results also demonstrate, that is important to continually expand marketing and promotional activities. Thanks to then will the website *kamnaspiši* get into ears to the inhabitants of other areas of Slovakia and later beyond national borders. For this step is necessary to create the language modification of website and Facebook.

6.2 Geocaching in Spiš

Under the pilot project called *Spiš Caching* were in the region Spiš hidden 13 *caches*. Since its inception in May 2015 until January 2016 (including), these caches discovered 779 users and most of them said, that they haven't known about the existence of such beauties and treasures. For example it can be geyser Sibá brada, metallurgical factory in Štefanská Huta or Lake Úhorná. These findings suggest that game *geocaching* can be used as a marketing tool.

6.3 Project partners

The basis for the successful completion of the project *kamnaspiši* is cooperation of organizations, businessmen and craftsmen. Over the past months there were a number of negotiations with businessmen and interest associations. The results are several agreements on mutual promotion. To this day are involved businessmen (Levos Nálepko, Grower distillery

Smižany), local self-governments (Smolník, Rudnany, Pavľany, Dlhé Stráže, Levoča, Spišská Nová Ves), interest associations (KSTAC Lokomtíva Bane - SNV, TK Vojkovce Sľubica), civil associations (Sans Souci - summerhouse Iliášovce, mining museum Hnilčík, Shelter for dogs - Happy dog Matejovce nad Hronádom) and state institutions (Spiš Museum in Levoča).

Cooperation with these subjects will be developed, as well as effort will be made to find additional partners to establish a comprehensive product of services and experiences. The product of this character is missing in the domestic market and is a potential for development of the region. For successful implementation is necessary to create a network of suppliers in the place of the stops of future sightseeing tour. Suppliers will ensure that the desired product or service will be provided at the required location, in the required time and in the required quality and quantity.

Conclusion

The main problem of the region is insufficient application of the principles of logistics. The result is a decrease of interest in the region, which significantly affects the level of employment and quality of resident's life. The analysis showed that the biggest problem of the region Spiš is an inadequate information flow and missing connections between sights and monuments. On another hand, the region has a wide range of services and has a lot of uniqueness, which can be the subject of interest. In order to use the potential of the region for its future development were in this article presented various suggestions, which are characterized by the need for mutual connection of the individual components examined logistics system.

The aim of local self-governments is satisfy the needs of resident population. Tool for it is range of services, which should be continually expanded according to public interest. In order to maintain sales or elicit demand for services and products is important not to neglect the power of information and marketing. Information flow considerably affects the purchasing behaviour of consumers.

Ambition of presented suggestions is to create a network of partner's businessmen and various organizations, which would bring to the market a new unique product. This common product, themed trips or sightseeing tour, can increase interest of region Spiš. Participant will obtain all the services, which he needs for satisfaction of needs. During the trip or tour he will obtain information and also the added value of the experience.

Discovering interesting places in region or city using organized trip is the most frequently was to increase the purchasing behaviour of consumers abroad. The offer is interesting for consumers because his needs to visit the place will be filled; he has a comfortable transfer to the destination and back and often arise savings.

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Demand for this product would provide material and financial flows that are essential for the development of the region. Formation of new market opportunities not only affect the development of the region and can ultimately lead to the creation of new job positions.

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