

## **A Model for Allocation of Limited Resources for Technological Improvement: A Case of Courier Service**

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*One of the basic questions in the field of microeconomics is how to make decisions about allocation of limited resources for technological improvement. The aim of this study is to propose a model that will help firms in making this kind of decisions. The model proposed in this paper - ALIRETI model, puts employees' stress level in the central place. There was a hypothesis introduced that based on stress level analyses in correlation with particular parameters of business, the recommendations for improvements can be reached.*

*As a data collection tool, two questionnaires were used. The first questionnaire was related to stress test. The purpose of the second questionnaire was to determine employees' attitudes towards predefined business parameters.*

*In order to get information about what should be changed first Work Stress Index – WSI is introduced. Higher value of  $WSI_i$  indicates that in the case of the lack of resources for comprehensive changes, higher priority in improvement should be given to business parameter  $i$ .*

*The ALIRETI model was tested and verified in a research carried out in Serbian Post. One of the improvement points that were indicated as a result of the model's implementation was the communication between dispatcher and couriers. This segment of courier service is further analyzed in this paper.*

*The main contributions of this paper are: the design of a new model for the allocation of limited resources for technological improvement, a manifestation of model's applicability and a proposal of new communication system for courier service in Serbian Post.*

**Keywords:** *business process, technological improvement, ALIRETI model, workplace stress, couriers, courier service, communications.*

### **Introduction**

A model for allocation of limited resources for technological improvement – ALIRETI model, was created as a result of authors' aspiration to define a model for performance measurement. Many authors have analyzed various systems in this area of economy.

Hence, the model proposed in this paper gives some kind of information about company's performance, but furthermore it also determines the exact part of business process where an improvement should be done. If it turns out that there are several improvement points, the model gives the information what is the most serious problem and where the limited resources should be allocated first.

Hence, the basic aim of this study was to propose a methodology for evaluating the status of business process in a company, determination of possible improvement points, ranking the importance of these improvement points and by that getting directions about allocation of limited resources in order to achieve optimal organizational results. Additionally, the goal was to demonstrate the model's applicability in companies; the empirical example is given analyzing the courier service of Serbian Post accordingly. Moreover, the final aim was to choose one of the possible improvement points and discuss its improvement in details.

The proposed model puts employees' stress level in the central place. The motive to define such a model appeared in a research carried out in Serbian Post by the authors. It was an attempt to assess the efficiency of courier service in the company. By analyzing the couriers, it was concluded that their job is quite demanding and stressful. They deal with various types of people, strict deadlines and manipulating with less or more valuable goods. Additionally, express courier industry is quite changeable. This refers to every day business, in terms of routes, clients, demands and on the other hand, in general, in respect of technology, expectations, etc. Therefore, couriers are under some kind of pressure and stress caused by work nature. For this reason it is interesting to test their stress level. However, basic assumption is that employees' stress level, beside other factors, greatly depends on manager's capabilities to organize business. There is a hypothesis introduced that based on stress level analyses in correlation with particular parameters of business, the recommendations for improvements can be reached.

One of the improvement points that were indicated as a result of the model's implementation was the communication between dispatcher and couriers. This segment of courier service is further analyzed in this paper. The organization of the study is as follows: in the next section, the ALIRETI model is described. After that, to demonstrate the model's applicability, empirical example

is given considering express courier service. Then, the impact dispatcher-courier telecommunication system on technological process is considered. As a result, a new system of communication between dispatcher and couriers is proposed to be implemented.

**Proposed model for allocation of limited resources for technological improvement – ALIRETI model**

It can be noticed from many research papers (such as Alas & Edwards, 2011) that employees and their attitudes are the basis for designing the models related to business process improvements. The same is valid for the ALIRETI model, which is designed and proposed by the authors of this paper. In the model, beside employees’ attitudes, workplace stress levels are in the central place.

There are a number of references in literature about work stress (see LaMontagne, 2007) and revolutionary changes in modern work organization which impose a need for employees’ mental health analyses (Sauter, 2002). In order to create a sustainable work system, one of the basic rules should be that managers’ expectations should not cause overstressed employees. This is particularly important if a system is expected to be long lasting.

Generally person’s stress level could depend on various factors; in professional literature called stressors (Stranks, 2005). On one hand, stress could be caused by factors that are independent from work and on the other hand from factors related to the business process. If we analyze work caused stress, there are some objective stressors like work nature, position at work, responsibility and others that could not be changed. However, one of the most important elements that influence stress level is the way the business is organized and it depends on the manager’s capabilities. The ALIRETI model suggests investigating the relationship between employees’ stress level and various parameters of the business process. In this way, certain conclusions can be reached about the status of the business process and possible improvement points. Parameters of business process should be unique for each company or each department in a company. After we locate all the business parameters that are relevant for our organization, we should carry out the research implementing the proposed model. The structure of the ALIRETI model can be seen in Figure 1.

First, it is necessary to choose one of the numerous stress tests. In this paper BHC test is used (Behavioral Health Concepts team, 2000) and it will be further described in the following text. Then we need employees’ opinion about the predefined business parameters or just need to determine the state of the system regarding these parameters. After that, we need to calculate a correlation between stress level and particular business parameter. If there is a correlation, then we can conclude that there is a possibility for the improvement of this parameter. If there is no correlation, there is no need to change anything.

As a data collection tool, two questionnaires were used. In order to ensure that workers would not hide any sensitive information, the questionnaires were anonymous.

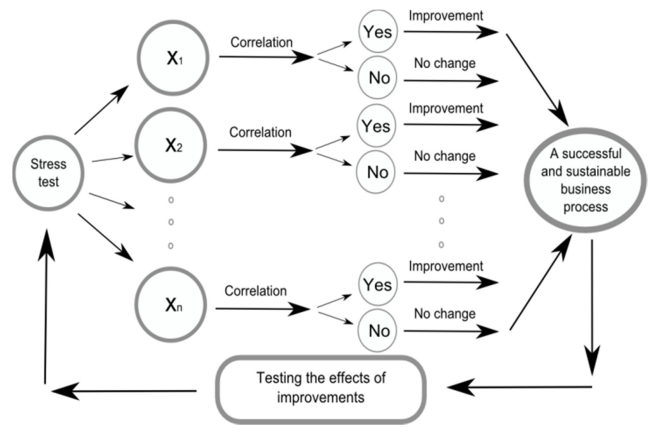


Figure 1. The ALIRETI model

Throughout the data collection process, every employee was assured that the responses would be kept confidential and all results would be presented only on an aggregate level. No managers of the company were present during the survey. Each employee was expected to fill two questionnaires. The first concerns the employee’s stress level. For this purpose, BHC stress test (Behavioral Health Concepts team, 2000) was used. It is a standardized questionnaire that contains 27 questions. This test was designed to be a self-report measure of each of the key dimensions of stress (Holcomb, 1998): Quality of Life, Symptomatology and Level of Functioning. There are numerous authors analyzing the phenomenon of quality of life (Pukeliene & Starkauskiene, 2011; Veenhoven, 2005, 2009; Cummins, 1996, 2000). However, the Quality of Life section of BHC Stress Test was developed out of a research with clients in a hospital and in community residential treatment facilities (Holcomb, 1993). The second section of BHC Stress Test deals with Symptomatology. It represents a set of symptoms manifested by the subjects. Original research on this section was described by Holcomb (1983). The third section measures self-reported Level of Functioning and it is developed by Holcomb (1994). The creators of BHC Stress Test proved that the test meets the necessary psychometric properties (Behavioral Health Concepts team, 2000).

The answers were processed by the software that was available on Internet for free (Behavioral Health Concepts team, 2000). As a result, there are four scales that show overall score, quality of life score, symptom distress score and level of functioning score. Depending on the score value, a subject can be classified into one of the four categories for each scale mentioned above. These categories are: well adjusted, stressed, very stressed and extremely stressed.

The second questionnaire that employee should fill was related to the business process. It should be written specifically for each organization and it must reflect as large picture as possible about the company and about employees’ attitudes related to the business process.

Since there were a small number of examinees in this study (29 couriers), Fisher’s exact test was used in order to examine the correlation between stress level of employees and particular parameters of the business process. In the

case of a large number of examinees (above 100) another methodology should be used (see Dobrodolac et al., 2010). To calculate correlation, a frequency distribution of appearance in some of the stress categories should be analyzed (well adjusted, stressed, very stressed and extremely stressed). After we make a conclusion about the existence of mentioned kind of correlation, we should concentrate on the parameters of the business process that are significantly correlated with employees' stress level and make further analyses how to achieve an improvement.

In order to get information about what should be changed first Work Stress Index – WSI is introduced. Unlike in case of correlation calculation, where frequencies were analyzed, in the case of WSI, we treat the average values of overall scores obtained from BHC stress test. We should notice a group of employees in some position or having certain attitude, but with highest stress level, analyzed for every parameter of the business process. WSI can be calculated by following formula:

$$WSI_i = \frac{\sum_{j=1}^{n_i} OSS_j}{n_i} \cdot \frac{n}{\sum_{z=1}^n OSS_z}$$

where  $WSI_i$  is work stress index for the business process parameter number  $i$ ,  $n_i$  is the number of employees in the group with elevated stress level for the observed business process parameter  $i$ ,  $OSS_j$  is overall stress score for an employee in the group with elevated stress level,  $OSS_z$  is overall stress score for each employee and  $n$  is the number of all employees participating in a survey. Higher value of  $WSI_i$  indicates that in the case of the lack of resources for comprehensive changes, higher priority in improvement should be given to business parameter  $i$ .

### **The model implementation in the case of courier service**

The examinees in this study were couriers that work in courier service sector in Serbian Post. Their duties are to pick up the mail at client's home or business address, transport and deliver it. In the phase of collection the mail, they estimate the weight of shipment, calculate and charge the postage, fill in appropriate documents, inform the clients about the possibilities and procedures for using courier services and eventually they take care about packaging. Besides driving the vehicle, they should take care about vehicle servicing as well.

Couriers are expected to present their company in the best way, to establish a good relationship with customers, to meet their demands, to accomplish all tasks professionally within the prescribed time frame. Additionally, they are faced with a large number of people of various profiles; they are responsible for the funds collected during working hours; subject to weather conditions, from extremely low temperatures and winter driving conditions to extremely high temperatures during the summer. Therefore, this is a relatively stressful job caring considerable responsibility.

There were 45 Post Express couriers working on the territory of Belgrade at the moment of this research. There were 36 of them who accepted to fill in the questionnaire. In final data processing, it was included only 29 couriers who gave the complete answers to all the questions. Incomplete questionnaires were not analyzed because the implemented software for stress test gives the results only if all answers are filled. Thus, the response rate was 64.4 %.

In order to analyze the couriers' business process, the following parameters were examined:

- (1) Home-to-work travel time,
- (2) Couriers' opinion about their immediate superior abilities,
- (3) Couriers' moving through the city - routing,
- (4) Communication between courier and dispatcher,
- (5) Shift work,
- (6) An adequate number of engaged couriers,
- (7) Personal income.

Transportation time from home to work and back is an interesting parameter for the analysis having in mind that courier system is present at almost every part of the city. Depending on the results, the technological process could be adapted to the needs of employees in the way that they could start their work at more suitable locations.

Considering the task to organize a courier service, it could be said that this is a relatively complex activity depending largely on the abilities of managers. It is interesting to hear the opinion of couriers on their superior's abilities. Additionally, closely associated with managing is a question of defining the technological process, which mainly includes a courier routing method, the type of communications between courier and dispatcher and the number of hired couriers. Couriers have given their opinion on these issues.

Couriers can work in the first, middle or the second shift. Shift work may be disturbing for almost every employee. It is interesting to know how working in shifts affects the couriers and what they think about it.

When the respondents were asked about work motivation, most of them reported that this is the salary. The study examines the relationship between attitude on the amount of personal income and stress levels of employees.

In Table 2, the results of correlation between stress level and business organization parameters, calculated according to described methodology, are shown. A research model with possible improvement points is illustrated in Figure 2.

Based on the results, it can be concluded that the improvement should be done only in the field of superior's abilities and communication between courier and dispatcher.

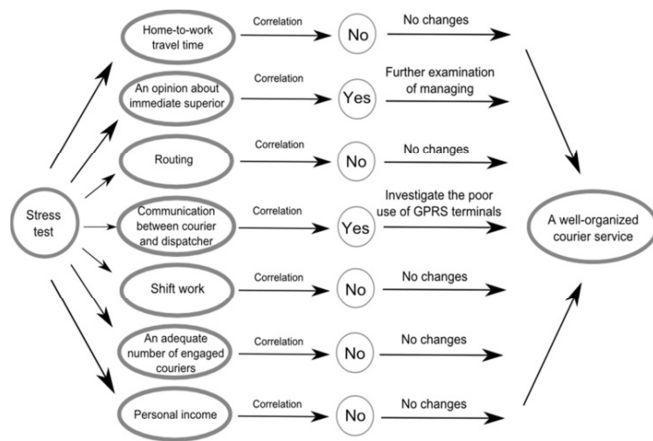
Couriers assessed their immediate superior by grade from 1 to 5, where 1 was completely unsatisfactory rating and 5 was the best. The largest number of responders gave a grade 3 (44.83 %) and 4 (37.93 %). However, depending on the answers, respondents were divided into two groups, one of those who have rated their immediate superior poorly, which was regarded as grade 3 or less, and the second group consisted of those who have evaluated them with grades 4 and 5. As it could be expected, higher level

of stress was expressed by those who are not satisfied with the abilities of their superiors. The recommendation for the company would be to examine the employees' attitudes on this issue further and accordingly to analyze the way of organizer's managing.

Table 1

**The results of Fisher's exact test of independence, DF for each parameter = 1**

| Business parameter   | Key dimension of stress | Significant correlation | One-sided P value |
|--|-------------------------|-------------------------|-------------------|
| (1) Home-to-work travel time                                   | Overall stress          | No                      | 0.1649            |
| (2) Couriers' opinion about their immediate superior abilities | Overall stress          | Yes                     | 0.0199            |
| (3) Couriers' moving through the city – routing                | Overall stress          | No                      | 0.1649            |
| (4) Communication between courier and dispatcher               | Overall stress          | Yes                     | 0.0180            |
| (5) Shift work   | Overall stress          | No                      | 0.4336            |
| (6) An adequate number of engaged couriers                     | Overall stress          | No                      | 0.4336            |
| (7) Personal income  | Overall stress          | No                      | 0.6743            |



**Figure 2.** The ALIRETI model in case of courier service with the recommendations for further activities

The second improvement point was the communication between dispatcher and courier. Even though the calculation of WSI indicated that the priority should be given to the first business parameter ( $WSI_1 = 0.139214$  and  $WSI_2 = 0.078807$ , where  $i=1$  is for Couriers' opinion about their immediate superior abilities and  $i=2$  is for Communication between courier and dispatcher), we decided to analyze the second parameter further in this study. The reason lies in the fact that the improvement of communication between dispatcher and couriers was bigger technological challenge for authors. This segment of business process is further analyzed in the next section. Certainly, the recommendation for the company would be to analyze a relationship between couriers and their immediate superior further.

### Communication between dispatcher and courier

Communication between dispatcher and couriers can be established in three different ways: by talking via mobile phone, by sending SMS messages to courier or by using GPRS communication terminals. Considering the efficiency of technological process, the best way to communicate is by using GPRS terminals. However, due to poor equipment quality or insufficient signal coverage, in order to direct the courier to specific address, in most cases, the communication via SMS was used. The couriers were asked whether they were satisfied with that way of communication. The number of respondents who expressed a positive view of the existing communication was 55.17 %, which is much more that was expected by the authors. However, although a negative opinion was expressed by 44.83 % of responders, it was demonstrated that there was a correlation between stress level of employees and expressed views about the way of communication. The role of this communication system and some recommendations for its improvement will be described further.

#### *The impact of dispatcher – courier telecommunication system on technological process*

Depending on the use of appropriate communication means, manual and automated technological process of courier service can be distinguished. In the first case, communication with the courier is done via mobile phone, by calling the courier or by sending him/her SMS messages. The second, automated system uses the modern GPRS terminals.

The scheme of manual technological process is shown in Figure 3. Technological process begins with client's giving the mail at Post Office counter or, like more common case, by calling the Call Center in order to ask for a courier to come to client's home or business address. The request of sender is registered at the central server and forwarded to dispatcher. He/she has to determine to which courier the request should be send. Regarding this request, the courier must be provided by information about the sender, recipient, type of requested services, some specific services, weight and shipping volume and the way of payment.

In the manual technological process, courier receives the information via SMS or during a direct conversation via mobile phones. Problems that arise in this kind of work may be various. One of the problems is a small capacity of SMS message. All the necessary information can not be always conveyed in a single SMS message. Then, the cost of calls via mobile phones can significantly increase the cost of service. Also, if the conversation takes place while driving, it results in courier's reduced security because courier needs to note the data for following pick up. The issue of safety should be explained to couriers in specific developed programs (for example see Cicevic et al., 2011). Additionally, by using SMS communication, there is a great possibility that an error occurs in the work.



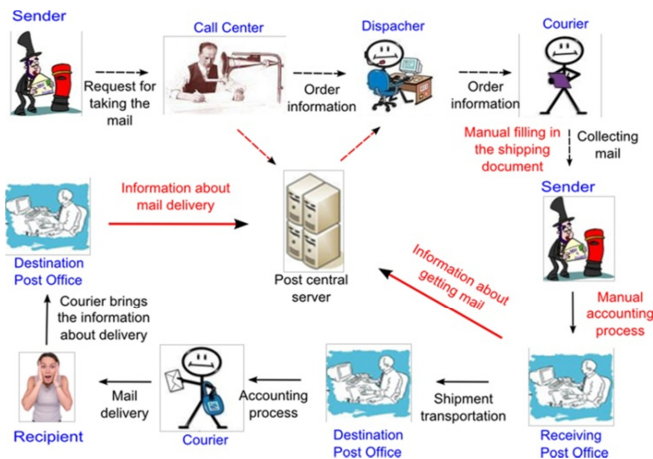


Figure 3. Manual technological process of courier service

When the courier arrives at the location in order to take the mail, shipping document should be filled in. The courier manually fills in the document with data obtained from dispatcher, but after they are verified by sender. The sender gets a copy of shipping document as evidence that the shipment was submitted to the transportation. The other copies follow the mail during the transportation.

The items collected during the working day, courier brings to Receiving Post Office. Shipments are unloaded from the vehicle and enter the sorting process. Courier has an obligation to visit the accounting worker to give the evidence about the mail that has been taken during that day and to deliver all collected money, if some senders paid the postage in cash. Accounting worker has to register every item, entering the data into computer for each of them. Working in manual technological process means that information about each shipment should be handled manually.

When the shipment arrives at the destination point, couriers need to prepare the shipments for delivery. For this purpose, every courier gets the delivery book, representing the document where all the items to be delivered are listed. In this book, the recipient puts its signature as a proof that the mail has been delivered.

After all deliveries are done, courier returns to Destination Post Office, to the accounting worker. Accounting worker reads from delivery book information about delivered mail and the time of delivery and puts it into computer. This is the end of manual technology process.

What has brought the technological process to automatic one is the implementation of modern GPRS mobile terminals (Figure 4). They greatly facilitate the phase of receiving shipment. In this case, all data received in the call center, are available to courier via GPRS terminal in electronic form. As previously mentioned, there are data about shipments, the type of asked service, the sender, recipient, the way of payment, special services, etc. Compared to mobile phone conversation, this kind of work brings to cost savings and increased courier's security while driving.

This way of technological process leads to the reduction in errors and better collection of postage. One of the numerous advantages is that the postage is automatically calculated. All data received in call center are available to

courier during mail collection. After sender's confirmation, the postage is automatically calculated.

By considering mail collection, the next advantage of automated process refers to filling in the shipping document. Having in mind that all data in electronic form are available to courier over the server, there is no need for hand writing. Courier just has to print the document using GPRS terminal. This reduces the time spent on collecting location, i.e. accelerates the technological process, reducing the costs and bringing to increased productivity of a company. On printed document, there is also a bar code, so there are savings on bar code labels as well.

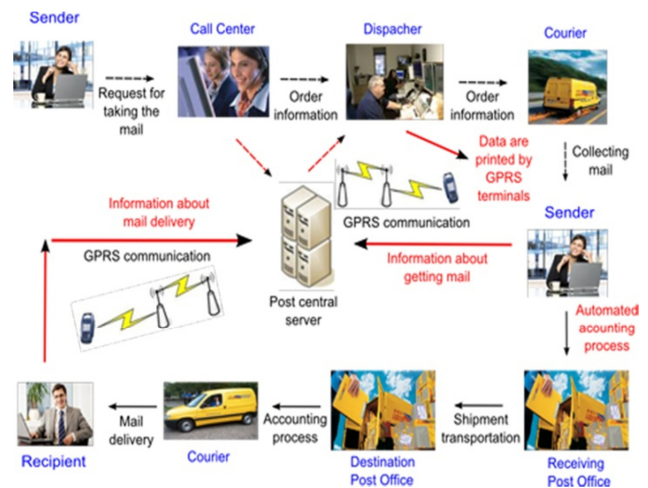


Figure 4. Automated technological process of courier service

GPRS terminals are connected to the central server of Post and the transmission of information about collected shipment exists in real-time. Therefore, the connection with Track and Trace system for tracking shipments is enabled in this way.

Upon arrival in the Receiving Post Office, courier's discharge procedure is much simpler and shorter because all data are already on central server. Therefore, there should be fewer employees engaged on data entry resulting in a reduction of total costs.

In delivery phase, in the case of GPRS terminal use, delivery book exists only to be signed by recipient as a paper proof that the shipment is received. All the remaining necessary data is entered into the mobile terminal. Additionally, the delivery information is immediately transmitted to the central server although the courier has not yet returned to the Post Office. The data are automatically ready for discharge before his return and accounting employee only check whether a particular assigned shipment status is correct. In this stage, on-line transmission of information about the status of delivery is used in order to monitor the process of delivery in real-time, supporting the Track and Trace system.

Comparing manual and automated technological process, it can be concluded that there are many advantages achieved by using GPRS terminal. These benefits greatly contribute to cost reducing, increasing speed of provided services, better utilization of labor, increasing the quality of services and productivity. However, beside all these advantages, the automated

system is used in a very small number of cases. The most common reason for this is poor signal availability for GPRS terminals because the system is designed to be part of a public communication network. Couriers often move through the various warehouse zones, sometimes placed underground, which produce problems with signal coverage. Another problem lies in the poor equipment quality. As a potential solution to this problem, some of the Private Mobile Radio systems can be implemented. In further text, some parameters for adequate communication system design are introduced.

#### ***Design parameters for the communication system***

As it was investigated, the existing communication system that was the part of public network has not met the expectations. Therefore, a new communication system should be introduced. As a possible solution, Private Mobile Radio systems, also known as communication systems for closed user groups, can be implemented. In further text, some basic expectations of these systems will be introduced.

**Coverage.** Closed user groups require a high level of geographical coverage of their mobile communication systems. This implies that the inaccessible regions, such as the basements or distant warehouses where the couriers often collect or deliver items, should not introduce any restrictions regarding the possibility of connection. Lack of coverage significantly reduces the operational efficiency of couriers, which leads to pure quality of courier service.

**Availability.** It is important that express mail industry has the access to communication services with acceptable quality level. Quality level of mobile communication systems must meet the traffic needs in peak hours. The network must be flexible enough to support communications in emergency situations such as the failure of some element of network. In order to provide the required level of quality, mobile communication system must support access to voice and data services using and combining some of the following mechanisms:

- Preemption, i.e. if all network resources are busy, user must have a possibility of priority call initiating. There should be the procedure that can free up resources needed for establishing this kind of call,
- The assignment and management of the frequency band dedicated to the customers in terms of congestion in the network,
- Facilitating the network management in the case of congestion should be achieved by direct communication between two mobile stations without using the base stations.

**Reliability and flexibility.** One of the key requirements should be that the infrastructure has maximum flexibility with a sufficient number of redundant elements, so that individual failures can not cause system failure. Individual components in the network must have the ability to communicate in different ways, so in case of broken link, communication should be achieved through a local base station that covers a specific operation area.

**Security.** Security and confidentiality are fundamental to the activities of closed user groups. The network must be protected against misuse and unauthorized access to

data and resources, including expanded encryption techniques and user authentication.

In addition to the above requirements, there are some other requirements, such as high quality audio for use in noisy environments, support for GPS positioning, full color display for accurate display of pictures and maps.

Very important feature of every communication system is its possibility of expansion. Some users can start with small number of people in group, with low rate of communication services utilization. After some time, demands usually arise and network should be able to adjust, for example to add new users, increase coverage (geographical or in-building), work in multiple dispatcher system etc.

In order to deliver flexibility and reduce training overheads, some key elements must be considered when selecting terminals such as common user interface across mobiles and portables, one-touch functions and ease-of-configuration (Motorola Australia 2010).

In the past, several digital trunked Professional Mobile Radio systems have been developed by different manufacturers for public and nonpublic applications. In the United States these systems are known as digital *specialized mobile radio* (SMR), whereas in Europe this service is called *public access mobile radio* (PAMR). The first attempts to develop digital systems of this type date back to the second half of the 1980s (Ketterling, 2004).

Some of the most popular systems of this type in Europe are TETRA, EDACS and TETRAPOL. Most of these systems no longer play a significant role with one exception – TETRA, because manufacturers strongly promote this communication system. Communication system iDEN holds a significant market share in the United States and many other countries (Motorola USA, 2010).

Professional Mobile Radio systems have a variety of application possibilities. They are used by Police, Military, Fire Departments, Ambulance, Transportation companies and other industries. In the next section, a possible implementation in the postal sector is demonstrated.

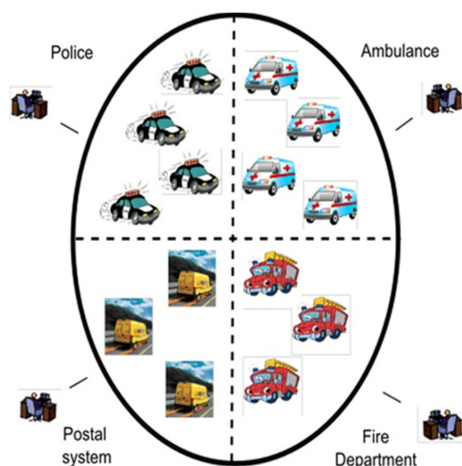
#### ***The implementation of professional mobile radio in postal system***

The importance of adequate communication system for the efficiency of technological process in postal system, especially in express mail industry is previously explained. By analyzing the situation in the postal system of Serbia it can be concluded that there are huge opportunities for improvements in the field of communications. As a potential solution some of the systems for Professional Mobile Radio can be applied.

In the process of communication system design it is necessary to take into account the economic parameter, i.e. the overall costs. In that sense, good characteristic of Professional Mobile Radio system is that more departments or services using communication for closed user groups may use a common infrastructure, but to have a separate functioning. Thus, the introduction of such system should involve coordinating the various administrations interested in the use of communication system for closed user groups. Many independent organizations (public or private) can form their own sub-

systems within a single infrastructure and thus work smoothly with the simultaneous distribution of the total investment cost.

Given that many postal systems are state-owned and that many Professional Mobile Radio users are also state organizations such as police, fire department, ambulance, etc. in this case it is very useful to form an integral state strategy for communication development. An example of different independent services working within a common infrastructure is shown in Figure 5.



**Figure 5.** Independent networks within a common infrastructure

When governments plan to improve communications for their public services, it has two options available:

- To build one or more independent networks to serve one or more groups of users or
- To implement the required services in public mobile networks with the necessary protection mechanisms and support systems.

Regarding Serbian integral strategy, one should have in mind that TETRA communication system (TETRA, 2011) has been already implemented in Serbian Police Department. It would be useful to use the existing infrastructure for other services as well.

TETRA has been designed from the beginning as a trunked radio system that effectively and economically supports shared usage of the network by several organizations, yet maintaining privacy and mutual security. Virtual networking inside the TETRA network enables each organization to operate independently, but still enjoy the benefits of a large, high-functionality system with efficient resource employment (Damm Cellular Systems A/S, 2011).

The elements of infrastructure owned by provider and terminals owned by users can be from different manufacturers; total score results in lower costs and better equipment. One such network, which uses equipment from different manufacturers, was represented in Greece. Motorola, Nokia and Siemens were selected to provide the secure two-way radio communications system that was used by public safety agencies during the 2004 Olympic Games in Athens. There were two TETRA networks in function. Motorola and Nokia provided the terminals, while Siemens and Motorola were responsible for

communication systems with dispatcher. This new network, with over 100 base stations built in time of 10 months, during the Olympic Games served approximately 17,000 users and over 200,000 calls daily (Goliath, 2010).

Speaking about the implementation of TETRA systems in Serbian Post, the use may be broader than those described in courier service. This system could be a good support to other projects in postal system such as the project of APM (Automatic Vehicle Monitoring) or CAS (Centralized Alarm System). It is possible to set TETRA system as the basic network for transmission of information about the location and status of vehicles that are monitored by the APM system and transmission of alarm signals and data to the operational center of the CAS.

## Conclusions

Each modern company struggling for success on the competitive market tends to make continuous improvement of its business process in order to achieve high quality of products or services. Some solutions may be good at first glance, but if they are functioning in the way that they produce elevated employee stress, those solutions are not sustainable in the future and could lead to stagnation or decline in productivity.

Having this in mind, the main contributions of this paper are:

- The design of a new model for allocation of limited resources for technological improvement,
- A manifestation of model's applicability, demonstrating a case of courier service,
- A proposal of new communication system dispatcher/couriers to be implemented.

The advantage of the proposed model lies in its simplicity of realization and the possibility of wide application. It could be applied for different types of businesses, for both manufacturing and service industries, and also for various positions, from low working levels to highest management level. By using the proposed model, it is possible to analyze the existing state of business process in the company and get clear directions in which area improvement should be done.

The results obtained by the implementation of proposed model in Serbian Post indicated that one of the basic problems in courier service was a communication system between dispatcher and courier. Efficient communication system design leads to improved quality of service and saving in materials, labor and working time.

## Acknowledgement

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### **Ribotų resursų skyrimo technologiniam tobulinimui modelis: pasiuntinių tarnybos pavyzdys**

Santrauka

Vienas iš pagrindinių mikroekonomikos klausimų yra kaip tinkamai priimti sprendimus dėl ribotų išsų skyrimo technologijoms tobulinti. Šio darbo tikslas kaip tik yra pasiūlyti modelį, kuris padės priimti tokius sprendimus. Be to, šiame darbe pasiūlytas modelis duoda atsakymą apie kompanijos verslo proceso eigą ir darbuotojų požiūrį į ją. Taip pat, kaip modelio įdiegimo rezultata, kompanija gali gauti informaciją apie galimus tobulinimo būdus. Jei paaiškėja, kad yra keli tobulinimo būdai, modelis pateikia informaciją, kuri problema yra rimčiausia ir kuriai ribotos išsės turi būti paskirtos pirmiausiai.

Ribotų išsų skyrimo technologijoms tobulinti modelis buvo sukurtas pačių autorių siekio sudaryti veiklos įvertinimo modelį. Šiame darbe pasiūlytas modelis suteikia tam tikros rūšies informaciją apie kompanijos veiklą. Jis taip pat nustato tikslią verslo proceso vietą, kurią reikia patobulinti.

Į pagrindinę vietą modelis iškelia darbuotojų streso lygį. Motyvas sudaryti tokį modelį atsirado, kai autoriai vykdė tyrimą Serbijos pašte. Tai buvo bandymas įvertinti pasiuntinių paslaugos našumą kompanijoje. Tiriant pasiuntinių darbą buvo gauta išvada, kad jų darbas yra pakankamai sunkus ir



įtemptas. Tai davė mintį patikrinti darbuotojų streso lygį. Buvo iškelta hipotezė, kad remiantis streso lygio analize koreliacijoje su tam tikrais verslo parametrais, gali būti gautos rekomendacijos patobulinimams.

Dažniausiai asmens streso lygis gali priklausyti nuo įvairių veiksnių; kurie profesinėje literatūroje yra vadinami stresoriais (Stranks, 2005). Teigiama, kad stresą gali sukelti veiksniai, kurie nepriklauso nuo darbo, arba kaip tik su verslo procesu susiję veiksniai. Analizuojant darbo sukeltą stresą, egzistuoja tam tikri objektyvūs stresoriai, tokie kaip darbo pobūdis, užimamos pareigos, atsakomybė ir kiti, kurie gali niekada nesikeisti. Tačiau, vienas iš pačių svarbiausių elementų, darančių įtaką streso lygiui, yra verslo organizavimo būdas ir jis priklauso nuo vadovo gebėjimų. Šiame darbe pasiūlytas modelis siūlo ištirti santykius tarp darbuotojų streso lygio ir įvairių verslo proceso parametrų. Tokiu būdu, galima padaryti tam tikras išvadas apie verslo proceso būseną ir galimus tobulinimo būdus.

Verslo proceso parametrai turėtų būti taikomi individualiai kiekvienai kompanijai arba kiekvienam kompanijos skyriui. Tyrimui reikalingiems duomenims surinkti buvo panaudotos dvi anketos. Pirmoji anketa buvo susijusi su streso tikrinimu. Šiame darbe buvo panaudotas BHC testas (Behavioral Health Concepts team, 2000). Tai standartizuota anketa, sudaryta iš 27 klausimų. Antrąją anketą sudarė 12, iš kurių 6 buvo susiję su darbuotojų požiūriu į iš anksto apibrėžtus verslo parametrus apibūdinimu. Norint gauti informaciją apie tai, ką reikėtų keisti, pirmiausia įvedamas *Darbo streso indeksas* (angl. Work Stress Index) WSI. Aukštesnė WSI vertė rodo, kad kai trūksta resursų visapusiškiems pokyčiams, tobulinant reikia suteikti aukštesnį prioritetą verslo parametrai. Tiriamaisiais šiame tyrime buvo pasiuntiniai, dirbantys Serbijos pašto pasiuntinių tarnyboje. Šio tyrimo metu Belgrado teritorijoje dirbo 45 pasiuntiniai. 36 iš jų sutiko užpildyti anketą. Apdorojant galutinius duomenis, buvo įtraukti tik 29 pasiuntiniai, kurie išsamiai atsakė į visus klausimus. Ne iki galo užpildytos anketos nebuvo analizuojamos, nes įdiegta programinė įranga stresui tikrinti pateikia rezultatus tik tada, kai yra atsakyta į visus anketos klausimus. Tokiu būdu, atsakymų norma buvo 64.4%. Kadangi šiame darbe buvo mažas tiriamųjų skaičius, buvo panaudotas tikslus Fisher testas, siekiant išnagrinėti koreliaciją tarp darbuotojų streso lygio ir tam tikrų verslo proceso parametrų. Jei būtų didelis tiriamųjų skaičius (daugiau kaip 100), būtų panaudota kita metodika (žr. Dobrodolac ir kt., 2010). Norint apskaičiuoti koreliaciją, turi būti išanalizuotas atsiradimo dažnio pasiskirstymas kai kuriose streso kategorijose (gerai suderinta, įtempta, labai įtempta ir ypač įtempta). Skaičiuojant WSI, mes nagrinėjome vidutines visų rezultatų, gautų iš BHC streso testo, vertes. Norint išanalizuoti pasiuntinių verslo procesą, buvo išnagrinėti tokie parametrai: kelionės iš namų į darbą trukmė, pasiuntinių nuomonė apie jų tiesioginio vadovo gebėjimus, pasiuntinių judėjimas per miestą - maršrutas, komunikacija tarp pasiuntinio ir dispečerio, pamaininis darbas, atitinkamas užimtų pasiuntinių skaičius ir asmeninės pajamos.

Vienas iš būtinų tobulinti būdų, kurie buvo parodyti kaip modelio įdiegimo rezultatas, buvo komunikacija tarp dispečerio ir pasiuntinių. Šis pasiuntinių tarnybos segmentas toliau analizuojamas šiame darbe.

Komunikacija tarp dispečerio ir pasiuntinių gali vykti trimis būdais: kalbant mobiliuoju telefonu, siunčiant trumpasias žinutes pasiuntiniui arba naudojant GPRS komunikacijos terminalus. Atsižvelgiant į technologinio proceso našumą, geriausias komunikacijos būdas yra naudojant GPRS terminalus. Tačiau, dėl blogos įrangos kokybės ar nepakankamos signalo aprėpties, norint nukreipti pasiuntinį tam tikrais adresais, daugeliu atveju komunikacijai buvo naudojamos trumposios žinutės.

Pagal atitinkamą komunikacijos priemonių panaudojimą, pasiuntinių paslaugas galima suskirstyti į rankinį ir automatizuotą technologinį procesus. Pirmuoju atveju, komunikacija su pasiuntiniais vykdoma per mobiliąjį telefoną, skambinant pasiuntiniams arba siunčiant jam/jai trumpasias žinutes. Antroji, automatizuota sistema, naudoja šiuolaikinius GPRS terminalus.

Egzistuojanti komunikacijos sistema, kuri yra viešojo tinklo dalis, neatitiko lūkesčių. Todėl nutarta įdiegti naują komunikacijos sistemą. Vienas iš galimų sprendimų buvo siūlymas įdiegti privačią Mobiliojo radijo sistemą. Jos taip pat žinomos kaip komunikacinės sistemos skirtos uždarams vartotojų grupėms. Populiariausias šio tipo sistemos Europoje yra TETRA, EDACS ir TETRAPOL. Dauguma šių sistemų jau nebeatlieka svarbaus vaidmens, išskyrus vieną – TETRA, nes šią komunikacijos sistemą labai remia patys gamintojai. Komunikacijos sistema iDEN išlaiko nemažą rinkos dalį Jungtinėse Valstijose ir daugelyje kitų šalių. Profesionalios Mobilios radijo sistemos turi daugybę pritaikymo galimybių. Jas naudoja policija, kariuomenė, priešgaisrinės apsaugos departamentas, greitoji pagalba, transporto kompanijos ir kitos tarnybos bei pramonės šakos.

Kuriant komunikacinę sistemą būtina atsižvelgti į ekonominį parametrai, t. y. bendruosius kaštus. Privalumas profesionalios Mobilios radijo sistemos lyginant su kitomis yra tas, kad daugiau departamentų ar tarnybų, kurios naudoja komunikaciją uždarams vartotojų grupėms, gali naudoti bendrą infrastruktūrą, bet funkcionuoti atskirai. Tokiu būdu, tokios sistemos įdiegimas sujungtų įvairias administracijas, kurias domina komunikacinės sistemos panaudojimas uždarams vartotojų grupėms. Daug nepriklausomų organizacijų (viešųjų arba privačių) gali formuoti savo sistemes vienos infrastruktūros viduje, ir tokiu būdu sklandžiai dirbti su tuo pat metu vykstančiu bendrų investavimo kaštų paskirstymu.

Atsižvelgiant į tai, kad dauguma pašto sistemų yra valdomos valstybės ir, kad dauguma profesionalaus Mobiliojo radijo vartotojų yra taip pat valstybinės organizacijos, tokios kaip policija, priešgaisrinės apsaugos departamentas, greitoji pagalba ir kt., tokiu atveju labai naudinga suformuoti vientisą valstybės strategiją komunikacijai tobulinti. Serbijoje komunikacijos sistema TETRA (TETRA, 2011) jau yra įdiegta Serbijos Policijos departamente. Būtų naudinga panaudoti esamą infrastruktūrą ir kitoms tarnyboms.

Atsižvelgiant į ankstesnes mintis, pagrindinis šio darbo įnašas yra:

- sukūrimas naujo modelio, galinčio paskirti ribotas lėšas technologijoms tobulinti;
- modelio taikymo paskelbimas, pademonstruojant pasiuntinių tarnybos pavyzdį,
- pasiūlymas įdiegti naują komunikacijos sistemą dispečeris/pasiuntiniai.

Pasiūlyto modelio privalumas toks, kad jį galima nesudėtingai pritaikyti savo darbe. Taip pat jį galima taikyti skirtingoms gamybos, paslaugų pramonės šakoms įvairiais lygmenimis, t.y. nuo žemiausio darbininkų lygio iki aukščiausios vadovybės lygio. Naudojant pasiūlytą modelį galima analizuoti esamą kompanijos verslo proceso eigą ir gauti aiškius nurodymus, kurių sritį reikia tobulinti.

Raktažodžiai: *verslo procesas, technologinis tobulinimas, ALIRETI modelis, stresas darbo vietoje, pasiuntiniai, pasiuntinių tarnyba, ryšiai.*

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