



## ASSESSMENT OF THE MOST SIGNIFICANT IMPACTS OF ENVIRONMENT ON THE CHANGES IN COMPANY COST STRUCTURE

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### ABSTRACT

Companies are operating as integral parts of their environment, and thus, they depend on it, as well as on the changes that occur in the environment. They are usually unable to control environmental impacts, so they need to develop a system which can partially reduce these impacts; they need to adjust and synchronize with changes. Due to the development of this mechanism, companies could adapt their business activities to the most of the impacts from the environment, providing thereby the highest profit at the end of the fiscal year. The purpose of this paper is to point out the principles of designing a model that could enable the enterprise to assess the most important impacts from the environment, quantifying their influence on its cost structure. Decisions about necessary changes in system operations should be based on the results of calculations in order to achieve the results as defined in the dynamic plan, or control them within satisfying limits.

## I. INTRODUCTION

Nowadays, the companies' operating environment has become increasingly unstable<sup>1</sup>. Changes in the environment are regular, with the tendency of increasing its frequency and intensity as well<sup>2</sup>. Thus, the degree of overall uncertainty is becoming higher, making the business conditions more difficult and complicated, and therefore result in an increasingly fierce struggle for survival on the market. Due to the uncertainty of the environment companies should look in possible alternative directions of their further development in order to respond immediately to the challenges they are facing. Numerous studies have shown that variable uncertainties in the environment require a higher degree of flexibility<sup>3</sup>. Adjustments to operating conditions can be transient or long-lasting – lasting sometimes for years or even decades<sup>4</sup>. Changes in the environment are mostly rapid, transferring momentarily to the business process and resulting with a high degree of unpredictability. There are three types of uncertainty in general business environment emphasized in the literature on this subject: economic, political and technological uncertainty. *Economic uncertainty* (or macroeconomic instability) refers to the phenomenon of inflation (a type of uncertainty that is always present in the operation of financial markets), the drop in demand due to the appearance of competition, the uncontrolled growth<sup>5</sup>, as well as the exchange rate volatility. Another form of uncertainty in the environment is *political uncertainty*. Various, fundamentally different forms, may appear in this group – all with the same final result. This type of uncertainty is characterized by broader processes which relate to the change of political system (typically simultaneously followed by the change of the economic system), instability of the political system within a unified economic system (frequent changes in government structures), or frequent changes in business conditions which result from changes in government structures and changes of economic and political views. For example, periods of increased legislation uncertainty imply a reduced level of business investments<sup>6</sup>. Increased political uncertainty leads to lower foreign and private investments from the enterprise's parent country. The process can also be the opposite: a high degree of economic uncertainty could lead to political uncertainty as well. Hence, these two forms of uncertainty (economic and political) can be cumulative and interdependent<sup>7</sup>. *Technological innovations*, related to the development of both the product design and the manufacturing technology, is another form of uncertainty. Due to the potentials of new technology, which are not fully recognized, technological uncertainty can contribute to economic uncertainty<sup>8</sup>. Shorter product life cycle resulting from the appearance of new structural forms of the same products, and their higher

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<sup>1</sup>PereSikavica, *Temelji menadžmenta* (Zagreb: Školska knjiga, 2008), 145.

<sup>2</sup>Robert Zenzerovic, "Business' financial problems prediction - Croatian experience", *Ekonomika istraživanja* 22, no. 4 (2009):14.

<sup>3</sup>Isaac Dyrer and Erik Larsen, "From planning to strategy in the electricity industry", *Energy Policy* 29, no.13 (2001):1148.

<sup>4</sup>Peter Gunter and Jack Duncan, "Macro-environmental analysis for strategic management". *Long Range Planning* 23, no.6 (1990):98.

<sup>5</sup>Jay Bourgeois. "Strategic Goals, Perceived Uncertainty, and Economic Performance in Volatile Environments". *Academy Management Journal* 28, no.3, (1985):569.

<sup>6</sup>George Bittlingmayer. "Regulatory uncertainty and investment: evidence from antitrust enforcement". *Cato Journal* 20, no.3 (2001):298.

<sup>7</sup>Gary Fields. "Political Uncertainty Puts Freeze on Small Businesses". *Wall Street Journal*, October 28,2009,5.

<sup>8</sup>Sharon Alvarez and Jay Barney. "How Do Entrepreneurs Organize Firms Under Conditions of Uncertainty?" *Journal of Management* 31, no.5 (2005): 789.

structural/technological performance, the replacement of products with new ones of completely different design and properties, the high level of reduction in time needed for converting ideas into a product, the concentration of staff and equipment in development/ research centers, the automation and the increase of batches are only some of the challenges of the new era of technological development within the IT revolution, globalization and prevailing large technological systems. These technological systems have gained strength to the degree that in many cases they run not only economic but political systems as well. The system of control and the flow of power gradually have altered its direction from politics  $\Rightarrow$  economics to economics  $\Rightarrow$  politics. As the result of the aforementioned processes, several structurally different forms of instability are introduced, and conveyed towards the smaller economic systems (also often towards the larger systems), which is confirmed by the continuous process of change in ownership over the large economic systems in the oil and automotive industry, industry of electronics and control systems, telecommunications, banking, insurance, etc. Therefore, it can be concluded that production systems, as well as other business systems, are unprotected against the influence of the environment in any business condition. Indeed, the increased level of development of society implies an increased level of environmental impact, making the survival on the market more challenging. In economically and politically under-developed systems, sales and manufacturing markets are also underdeveloped and thus, the system instability is rather weak, similar to what it was at the time of socialism, in times of planned economy, which was controlled from a single administrative/political center<sup>9</sup>. Today, in the developed countries, such or similar systems do not exist. Thus, the struggle on the sales market is increasingly fierce, and besides major domestic manufacturers there are manufacturers from highly developed countries, as well as those from the emerging economies (China, Turkey, India and the others). Having in mind that companies are operating in a constantly changing environment, they need to be able to adapt to these changes<sup>10</sup>. For example, the level of production is unaffected only by the elements of demand, but it also depends on internal influences that do not necessarily have anything to do with external influences. A decrease in production may also appear in completely stable environmental conditions if the organization of production at the projected level is hindered as the result of internal weaknesses, e.g. the equipment is poorly maintained, the delivery of raw materials is not contracted in a timely manner, which leads to energy short-supply, workers' dissatisfaction, system break down, etc.

## II. MATHEMATICAL EXPRESSION OF COST STRUCTURE ELEMENTS IN CORRELATION WITH THE IMPACTS FROM THE ENVIRONMENT

There are an exceptionally large number of variables both in the environment and in the company that need to be considered in order to provide an overall picture of the current position of the company<sup>11</sup>. Due to the increasing number of elements in the environment, companies need to define the impact of each of the observed elements on their operation and assess the degree of impact, i.e. the intensity of impact on their operation<sup>12</sup>. Since every company

<sup>9</sup>Igor Ansoff and Patrick Sullivan. "Optimizing Profitability in Turbulent Environments: A Formula for Strategic Success". Long Range Planning 26, no.5 (1993):18.

<sup>10</sup>George Plossl. "Flexibility is now the key to survival for manufacturing". APICS-The Performance Advantage no.4 (1992):41.

<sup>11</sup>Bozidar Lekovic and Vojislav Vucenovic. *Menadžment-filozofija i tehnologija*. (Beograd: Želnid,1998),114.

<sup>12</sup>Maria Oltra and Luisa Flor. "The moderating effect of business strategy on the relationship between operations strategy and firms' results". International Journal of Operations and Production Management 30 no.6 (2010):615.

is a world itself it is clearly impossible to define general numerical value as 'influence coefficient' for all the companies; even for companies with the same product line. Hence, on the basis of general philosophy of impact of individual elements on the operation, in addition to the identification and evaluation of importance of individual correction coefficients, each company should be able to define them more precisely<sup>13</sup>. Thus, it would be useful to set up a mathematical model to define the assessment processes of environment impact towards business operations<sup>14</sup>. Prior to its application, it is necessary to specify the values of influence parameters which could be classified into three categories: a) *Data describing the current situation* - a group of internal corporate data, b) *Relationships between variables* that alter with changes, c) *Forecasts of future conditions*, which cannot be a precisely defined data. In developing a mathematical model, the uncertainty component has to be taken into account. The basic aim of the business plan development is defining the criteria according to which main principles and business guidelines will be established during the business year in order for the profit to reach either projected or reduced level, or at least to be kept above the minimum projected profit<sup>15</sup>. Since the business plan is developed prior to the beginning of financial, most often calendar year, the indisputable fact is that it is very hard to predict all business conditions, intensity of external and internal changes and influence on business plan realization in a company during a year. Developed business plan of a production system and its adaptability to the altered business conditions represent the guidelines for making adequate corrections to the business system and distribution of resources exploited by the production system. Considering the fact that only successful companies exist on the market, it can be concluded that every production system should have: optimal system of company's organization in all its functions, system of rational production with minimal expenses, efficient maintenance system, efficient and rational financial function, development of a company (product, technology, production, infrastructure) in accordance with market requirements, technology development and financial potentials. In order for the above mentioned five basic principles to be realized successfully, it is necessary to provide the required conditions. The realization of the following is planned: production structure and capacity, supply of production material, maintenance, development of products or technology, investments and others. They are all included in financial plan, which unifies them. Generally accepted business philosophy in the contemporary economic world is subjected to realization of a profit since it enables further operation and expansion of the business system. The development does not exist for itself alone or imagined profit. The true development has a real goal: achieving higher profit and gaining advantage on the market in comparison to the competition<sup>16</sup>. This goal is applied to all functions in the company: organizational, production, maintenance, supply-purchasing, financial and others. The basic problem in the process of defining the business principles during a business year is to provide balance between aims of the management and actual business system capacity and assessed business conditions. Since it is difficult to anticipate all possible changes of conditions with high accuracy under unstable business conditions, business plan can be defined only as initial framework, it can be susceptible to changes in accordance with changes of various external and internal influences. Moreover, it can provide the company's management with the

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<sup>13</sup>Masood Badri and others. "Operations strategy, environmental uncertainty and performance: A path analytic model of industries in developing countries", *Omega* 28, no.2 (2000):157.

<sup>14</sup>James Sisson. "How strategic is your planning?" *Journal / American Water Works Association* 84, no.11 (1992):44.

<sup>15</sup>Pere Sikavica. *Temelji menadžmenta*. (Zagreb: Školska knjiga, 2008), 198.

<sup>16</sup>Marić, Branislav and others. „Analysis of internal rate of return on investments: Dynamic and static approach“. *African Journal of Business Management* 5, no.8 (2011):3270.

possible guidelines in the business in order to stop, reduce or improve negative trends in the profit fall and/or some other business indicator. This paper focuses on flexible business plan that enables input on changes, according to which the influence on profit is then automatically calculated, some business elements are corrected so that characteristics of the system with so called feedback can be obtained. The difference between total incomes (I) and total expenditure (E) represents the profit of the business system (P)<sup>17</sup>. I and E are directly exposed to external and internal influences, which reduces the planned profit (P). The profit level is calculated by the computer. Depending on the external and internal character of the "influences" and the obtained profit value (P), correction coefficients are introduced as feedback which number and numerical value are in the function of the type of the change and average annual achieved profit  $K = f(P)$ . Total process – profit calculation and correction coefficients is conducted automatically, while the changes made in accordance with criteria defined by the model are recorded manually. Model can be developed and applied to business only if it has already been present in the company or if the system of realized/planned feedback flow has been introduced. This system represents permanent monitoring and comparison of the realized variables with the planned ones, as well as the analysis of the planned parameter deviations. Feedback system implies that it is necessary to monitor the changes of all marked external and/or internal influences and make corrections to the developed plans according to those changes. Model application provides the success and multiple benefits to the company with regard to additional control which is most often conducted in the companies. When the planned process is finished and standard deviation is determined, additional control provides information on the achieved business results<sup>18</sup>. This further leads to the reactive behaviour which will enable the use of earlier experience in order for the activities to be improved in the future. The value of feedback model lies in the proactive behaviour in the business management in the company. Deviations are identified at the moment of occurrence of the event which influences the change in business and not after the planned period. Every change is inserted into the program of the plan for business conditions as a feedback-input parameter. The influence on the business results is calculated by the set mathematical model and the obtained value is compared and adjusted with the previous variable. It can be a short-term correction but after entering the critical zone it is repeated until minimal profit is achieved. Therefore, a mathematical model set in such a way is called 'model of business plan feedback'. The basic concept of the business plan feedback model comprises few interrelated units: financial business plan, correction coefficient of business elements which structure and value depend on the level and characteristics of a change, mathematical expression for profit calculation, and. Model of graphical presentation of the profit in the function of change intensity of 'EI influence' and time of the occurrence.

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<sup>17</sup>Maric, Branislav. „Prikaz nove grafičke metode za utvrđivanje korigovane vrednosti interne stope rentabilnosti“. *Ekonomski pregled* 8, no.9 (1991):460.

<sup>18</sup>Marinko Vranković. *Uspešnost poslovanja–uticaj na dinamiku bilansa*. (Beograd: Visoka škola strukovnih studija za računovodstvo i berzansko poslovanje, 2009),111.

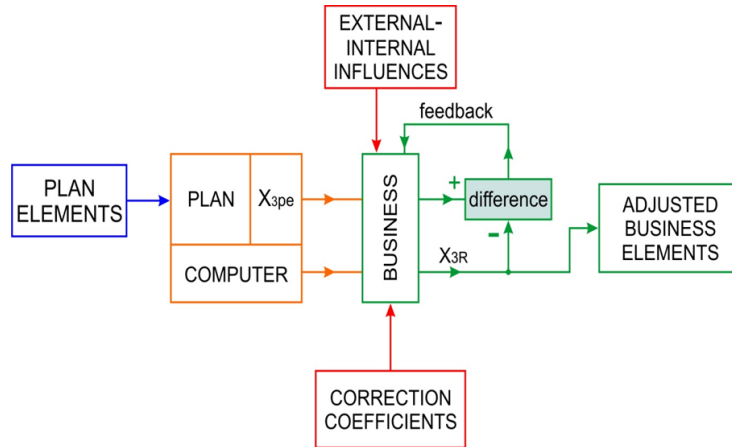


FIGURE 1. MECHANISM FOR BUSINESS FEEDBACK PLAN

Source: Authors

Given that the accurate prediction of future events is difficult and almost impossible task, the company is constantly facing certain business risks. While researching the principles for setting the model, the focus is on the financial dimension of success, as expressed by the income and expenditure in the periodic income statement, restored for reporting, interpreting and evaluating the economic success. There is a variety of different business impacts<sup>19</sup>: a) impacts of external origin – inflation, exchange rate changes, reduced sales volumes, increased energy prices, cutback in product prices, increased transportation costs, increased contributions and taxes, increased operating costs, increased interest rates on loans, etc. and b) impacts of internal origin – increased wages, reduced production, increased indebtedness, inadequate operation of the maintenance service, unplanned machine failures, etc. These external and internal influences almost never operate individually and in isolation from other influences<sup>20</sup>; instead, they usually operate simultaneously, in a group or individually – phase-shifted. Furthermore, the degree of impact on business operations is unequal as well. The combination of different number of impacts of varying levels and intensity on business activity would yield with thousands of different groups of influence. Therefore, for the purpose of this paper, the minimum number of individual impacts has been specified with the most significant reflections on the operation cost structure. The activities of these impacts can be combined and expressed (quantified) numerically. The most important impacts with maximum speed and intensity are reduced sales volume and/or change (decrease) in product prices, increased labor costs, energy prices and/or prices of raw materials, and changes in exchange rates. The main assumption when calculating the impact on business activity is based on the following generally accepted principle of business system and profit calculation: the operating profit (P) is equal to the difference of total incomes (I) and operating expenses (E). Consequently, it is necessary to set up a general mathematical model for calculating the operation with general coefficients for each individual impact. On the basis of numerically defined coefficients, this model is the basis for profit calculation of each

<sup>19</sup>Aaron Buchko. "Conceptualization and measurement of environmental uncertainty: an assessment of the miles and snow perceived environmental uncertainty scale". *Academy of Management Journal* 37, no. 2 (1994):412.

<sup>20</sup>Shaker Zahra and Donald Neubaum. "Competitive environment, technology strategy and company performance". *Proceedings of the Decision Science Institute Annual Meeting*, (1996):1267.

individual case<sup>21</sup>. If there is a possibility for the impact or the influential element itself to appear during the operation, it is necessary to assess its effect and respond depending on the intensity of its influence. The model should be simple and open to: the number of elements of the operation structure, the expansion of the number of operation elements influenced by the impact, as well as the change in numerical assessment of the impact<sup>22</sup>. Due to the introduction of mathematical model with a unified system of notation, the elements of operation are classified as in Table 1.

TABLE 1 – FRAMEWORK OF THE COST STRUCTURE

| <b>I<sub>1</sub></b> | <b>TOTAL INCOMES</b>               | <b>I<sub>1</sub> + I<sub>2</sub> + I<sub>3</sub></b>   |  |
|----------------------|------------------------------------|--|--|
| I <sub>1</sub>       | Incomes from the domestic market   |  | I <sub>3</sub> Other incomes   |
| I <sub>2</sub>       | Incomes from the foreign market    |  |  |
| <b>E<sub>2</sub></b> | <b>TOTAL EXPENSES</b>              |  | <b>E<sub>1</sub> + E<sub>2</sub> + E<sub>3</sub> + E<sub>4</sub></b> |
| E <sub>1</sub>       | <b>BUSINESS EXPENSES</b>           | <b>X<sub>211</sub> + X<sub>212</sub> + X<sub>213</sub> + X<sub>214</sub> + X<sub>215</sub> + X<sub>216</sub> + X<sub>217</sub> + X<sub>218</sub> + X<sub>219</sub></b> |  |
| E <sub>11</sub>      | Raw materials - domestic market    |  | E <sub>16</sub> Energy and fuel costs                                |
| E <sub>12</sub>      | Raw materials - foreign market     |  | E <sub>17</sub> Transportation costs                                 |
| E <sub>13</sub>      | Manufacturing services             |  | E <sub>18</sub> Maintenance costs                                    |
| E <sub>14</sub>      | Wages                              |  | E <sub>19</sub> Non-manufacturing services                           |
| E <sub>15</sub>      | Depreciation                       |  |  |
| E <sub>2</sub>       | <b>INVESTMENTS</b>                 | <b>E<sub>21</sub> + E<sub>22</sub></b>   |  |
| E <sub>21</sub>      | Investment maintenance             | E <sub>22</sub>  | Procurement of new equipment and construction of facilities          |
| E <sub>3</sub>       | <b>FINANCIAL EXPENSES</b>          | <b>E<sub>31</sub> + E<sub>32</sub> + E<sub>33</sub> + E<sub>34</sub></b>   |  |
| E <sub>31</sub>      | Loan expenses                      |  | E <sub>33</sub> Banking services                                     |
| E <sub>32</sub>      | Interest expenses                  |  | E <sub>34</sub> Other financial expenses                             |
| E <sub>4</sub>       | <b>OTHER EXPENSES</b>              | <b>E<sub>41</sub> + E<sub>42</sub> + E<sub>43</sub> + E<sub>44</sub> + E<sub>45</sub></b>  |  |
| E <sub>41</sub>      | Product development expenses       |  | E <sub>44</sub> Procurement of consumables                           |
| E <sub>42</sub>      | Marketing and advertising expenses |  | E <sub>45</sub> Other expenses                                       |
| E <sub>43</sub>      | Business trip expenses             |  |  |
| <b>P</b>             | <b>PROFIT</b>                      | <b>I – E</b>   |  |

Source: Author's calculation

Accordingly, it is possible to derive the equation for profit calculation in the general configuration, with the correction coefficients ( $k_{xyz}$ ) introduced with each business segment (Equation 2.1):

$$P = I - E \quad (1)$$

Where: P – profit, I – incomes, and E – expenditures.

The change of the influential element of the environment leads to the adequate changes in costs and such a change has been defined in the model by correction coefficient ( $k_{xyz}$ ) for every individual element of the cost structure.

<sup>21</sup>Andrea Ivanisevic and others. „Principles of Business Systems Design with a Feedback in the Function of an Environmental Impact Plan and Set Goals“. XV International Conference of Industrial Systems, (2011):398.

<sup>22</sup>Andrea Ivanisevic. „Razvoj sistema za planiranje, praćenje i usklađivanje poslovanja industrijskog sistema u skladu sa promenama u okruženju“ (Ph.D diss., Univerzitet u Novom Sadu, Fakultet tehničkih nauka Novi Sad, 2011).

External influences from the environment as well as internal influences can cause each of the currently active business segments to be changed depending on the intensity of the influence as well as on the specific company's structure. Therefore, correction coefficient ( $k_{xyz}$ ) – equations (2.2) and (2.3) have to be introduced in the basic formula in every business segment:

$$P = \sum_{i=1}^4 I_{1i} k_{1i} - \left( \sum_{i=1}^9 E_{1i} k_{21i} + \sum_{i=1}^2 E_{2i} k_{22i} + \sum_{i=1}^4 E_{3i} k_{23i} + \sum_{i=1}^5 E_{4i} k_{24i} \right) \quad (2)$$

The value of each coefficient ( $k_{xyz}$ ) is calculated based on the nature of the impact and the specific, economic and business characteristics ( $x$ ) of each company in particular:

$$k_{XYZ} = 1 \pm \frac{Y\%}{100} \cdot x \quad (3)$$

Where:  $Y$  – the value of change;  $x$  – the impact coefficient of change.

In addition to changes in business conditions, and various internal and external influences, changes in business conditions during the different annual cross-sections appear as an element of impact. This element varies, and during the year it does not change uniformly. Therefore, the calculation has to include the time-variable, which is described by the formula in a given cross-section ( $i$ ) and which calculates the influence of the impact on annual basis:

$$P_{Gi} = \frac{P_{G(i-1)} \cdot m}{m_G} + \frac{P_{Gi} \cdot (12-m)}{m_G} \quad (4)$$

where:  $i$  – the cross section based on which the annual profit is calculated;  $m$  – the number of months of operation preceding the  $i$ -th cross-section;  $m_G = 12$  (the number of annual months);  $P_{Gi}$  – the level of calculated profit in the  $i$ -th cross-section of change in EI conditions;  $P_{G(i-1)}$  – the level of calculated profit in the previous cross-section.

### III. MATHEMATICAL EXPRESSIONS OF INDIVIDUAL IMPACTS ON THE OPERATION

Reduction in sales volume can be caused by: a) reduced demand-drop in standard of living; b) reduced competition ability of the company; c) hindrance in technological development; d) opening the domestic market to foreign companies; e) problems related to the product placement in foreign market, etc. The final result of the reduced sales volume is the reduced profit in the first phase followed by the loss (in case that the reduction in sales continued) and finally bankruptcy–company's liquidation. The aim of this mathematical expression is to determine to what degree the reduced sales volume affects the profit reduction during a business year. Apart from the reduced profit, the reduced sales volume had other negative effects as well, such as: increase in inventory of finished products and raw materials, increased production costs, more current assets employed due to the increased production costs and other. These elements can have a significant influence on the reduction of the company's profit. Mathematical expression (3.1) was set in accordance with the following parameters:

- Drop in sale led to the decrease of incomes from domestic and foreign markets
- Fall in sale resulted in the reduction of inventory of raw materials from domestic and foreign markets, as well as the reduction of production (cooperative) services
- Fall in sale also had influence on the reduction in the supply of energy-generating products and transportation costs



**Reduction in sales volume** on profit is calculated according to the following formula:

$$P = \sum_{i=1}^2 I_i k_{1i} + I_3 - (\sum_{i=1}^2 E_{1i} k_{21i} + \sum_{i=3}^6 E_1 + \sum_{i=7}^9 E_{1i} k_{21i} + \sum_{i=12}^{15} E_{2i} k_{22i} + \sum_{i=14}^{15} E_{3i} k_{23i} + \sum_{i=15}^{15} E_{4i} k_{24i}) \quad (5)$$

The main cause for lowering the prices was the reduced demand for products due to: economic crisis (low purchasing power), new domestic or foreign manufacturers, hindrance in product development or other reasons. The other reason may also be 'disuse of product' which is caused by replacing the product of existing construction-technological concept with the other one that has the same purpose but completely different technological concept (e.g. changes in TV construction and design, development of digital technology in photography, etc.). A drop in prices can be caused by the increased production volume (opening of new markets, increased sale), which was not analyzed in this paper even though its simulation was possible. The aim of the mathematical expression (3.2) is to analyze the influence that reduced prices can have on company's business during a year with no changes in the production volume. The following parameters were set:

- Change in prices reduces the incomes from domestic and foreign markets but it does not reduce the costs of raw material supply or any other costs.

**Change in the product price** is calculated according to the following formula:

$$P = \sum_{i=1}^2 I_i k_{1i} + I_3 - (\sum_{i=1}^9 E_{1i} + E_2 + \sum_{i=1}^2 E_{3i} + E_4) \quad (6)$$

Mathematic expression 3.3 was set with the aim of analyzing the company's operation so that the future business results could be evaluated, whereat the growth in personal earnings was observed through the change in parameters of personal earnings.

**A labour cost is** calculated according to the following formula:

$$P = \sum_{i=1}^2 I_i - (\sum_{i=1}^9 E_{1i} + E_2 + \sum_{i=1}^2 E_{3i} + E_4) \quad (7)$$

Mathematical expression 3.4 was set with the aim of analyzing company's operation so that future business results could be evaluated whereat the increased energy prices were observed through the change in the following parameters: fuel and energy costs and transportation costs.

**Increased energy prices** are calculated according to the following formula:

$$P = \sum_{i=1}^2 I_i - (\sum_{i=1}^5 E_{1i} + \sum_{i=6}^7 E_{1i} k_{21i} + \sum_{i=8}^9 E_{1i} + E_2 + \sum_{i=1}^2 E_{3i} + E_4) \quad (8)$$

Mathematical expression 3.5 was set with the aim of analyzing company's operation so that future results could be evaluated, whereat the increased raw material prices were observed through the change in the following parameters: raw materials from domestic and foreign markets.

**Increased raw material costs** are calculated according to the following formula:

$$P = \sum_{i=1}^2 I_i - (\sum_{i=1}^3 E_i k_{21i} + \sum_{i=4}^9 E_{1i} + E_2 + \sum_{i=1}^2 E_{3i} + E_4) \quad (9)$$

The change in exchange rate represents the external impact on company's business. The influence of change in relations between domestic and foreign currencies (EURO, DOLLAR, SFR,

etc.) has different impacts on the company's business and they depend on the numerous elements such as:

- Relation between product placement in domestic and foreign markets,
- Relation between raw material supply from domestic and foreign markets,
- Indebtedness level and loan requirements.

It is obvious that different impacts cannot be included into a unique already given mathematical expression so it needs to be open for new entries. The reflection of changes in exchange rate on the company's business is also clear: lower value of domestic currency is good for the export oriented companies but it has negative impact on the companies which are mostly oriented to domestic market. Therefore, the general mathematical expression can be set in accordance with the following parameters:

- There are elements of change in the company's business that follow the change in the exchange rate in such a way that incomes from domestic market represent 'positive influence' while the raw material supply from the foreign market and loan repayment represent 'negative influence'.
- In case that bigger change in the exchange rate occurs, some elements of business will become more sensitive. Those elements are shown in the formula 3.6 and they are: raw material supply from domestic market, energy supply costs and transportation costs. In that case those elements are not affected directly but through an external supplier.

**Changes in exchange rates** are calculated according to the following formula:

$$P = I_1 + I_2 k_{12} - \left( \sum_{i=1}^2 E_{1i} k_{21i} + \sum_{i=3}^5 E_{1i} + \sum_{i=6}^7 E_{1i} k_{21i} + \sum_{i=8}^9 E_{1i} + E_2 + E_3 k_{231} + E_3 k_{232} + E_4 \right) \quad (10)$$

#### IV. CHANGES IN COST STRUCTURE DUE TO EXCHANGE RATE DEPRECIATION ON THE EXAMPLE OF REPRESENTATIVE COMPANY – A REVIEW ON SERBIA

Due to the increased competition on the import market and on the market of imported substitutive products, the degree of impact of exchange rate is lower. The existing competition has forced the importers and domestic manufacturers to sacrifice a part of their profit in order to outlive the competition. On the other hand, due to the existence of the so-called import lobby, these impacts are significantly intensified. If the prices are formed in Euros, the transmission is complete; if they are formed in RSD, the transmission may not be complete and depends on the competition and direction of changes in exchange rates. In order to address the issue of quantification of the impact of exchange rate changes on cost structure of the selected representative Serbian enterprise, it is necessary to consider the general business conditions in Serbia, with particularly significant adverse influence of external/internal impacts such as: the unstable RSD - EU exchange rate, U.S. dollar/SCFR exchange rate, increasingly poor market, stronger foreign competition without protection mechanism provided by the government, high inflation rate, latent discontent of the workers due to unbalanced ratio of wages and the costs of living, reflections of the energy crisis and constant increase of energy prices and transportation costs, potential risk of reduced production and forced reduction of product prices, regardless to the declining value of dinar and continuous rapid inflation trends, negative business environment for manufacturing systems (taxes, state budget, a high-level general consumption, reductions in the number of employees, etc.), high indebtedness, high interest rates, rapid jump of Euro, high mutual debts, etc. The export accounts for 27% of GDP, covering less than half of Serbian import,

and thus it is the lowest in the region. In addition to this quantitative aspect, the qualitative aspect is also unfavorable, making metals and food accounting for 40% of total exports, mainly in unprocessed form. Appreciation of real exchange rate is often cited as the factor which continuously de-stimulates the export sector but stimulates import activities. The Serbian economy is largely dependent on import inputs<sup>23</sup>. The presented model as the basis for calculation of environmental impacts on business operations may be applied as stated for various impact categories (Equation 3.1-3.6). This paper presents the calculation of the impact of changes in exchange rates within the defined cost structure (Table 1) during three financial year (2008, 2009 and 2010), always with the same starting annual business plan, on the representative model of the projected enterprise (Ivanisevic, 2011), which operation is ranging within the limits as expressed by MU (monetary units – the basic cash value adopted for this survey). The economic structure of the enterprise is the following: *It is a manufacturing enterprise with 40 employees; the total revenue is generated on the local market  $l_1 = 1000$  MU ("monetary units") and on the foreign market  $l_2 = 200$  MU (according to the version V1);  $l_1 = 1200$  MU (according to the version V2); total expenditures are distributed as follows: raw materials from the domestic market  $E_{11} = 210$  MU and from the foreign market  $E_{12} = 200$  MU; manufacturing services  $E_{13} = 80$  MU; personal wages  $E_{14} = 260$  MU; depreciation  $E_{15} = 25$  MU; fuel and energy costs  $E_{16} = 60$  MU; transportation costs  $E_{17} = 50$  MU; maintenance costs  $E_{18} = 55$  MU; non-manufacturing services  $E_{19} = 45$  MU; other costs  $E_{18} = 30$  MU; investment and development  $E_2 = 25$  MU; loan costs  $E_{31} = 50$  MU; other financial expenses  $E_{34} = 60$  MU; planned profit:  $P = 50$  MU.* According to the report of the National Bank of Serbia, during the three analyzed years, the exchange rate changed monthly (Table 2, Figures 1 and 2), from the initial value of 1 EU = 81.246 RSD (on 01/01/2008) to the value of 1 EU = 106.993 RSD (on 31/12/2010). During this period, the value of the RSD against the Euro has fluctuated, with the lowest value of 1EU = 76.089 RSD recorded in September 2008.

TABLE 2 – CHANGES IN THE EXCHANGE RATE IN 2008, 2009 AND 2010, ACCORDING TO THE REPORT BY NBS

| Year | I     | II    | III   | IV    | V     | VI     | VII    | VIII   | IX     | X      | XI     | XII    |
|------|-------|-------|-------|-------|-------|--------|--------|--------|--------|--------|--------|--------|
| 2008 | 88,19 | 81,47 | 82,68 | 82,02 | 79,93 | 80,75  | 79,12  | 77,84  | 76,08  | 76,32  | 83,97  | 87,77  |
| 2009 | 85,56 | 95,45 | 94,75 | 94,74 | 94,17 | 94,76  | 93,45  | 93,04  | 93,11  | 93,30  | 93,11  | 94,41  |
| 2010 | 96,16 | 97,43 | 98,92 | 99,73 | 99,04 | 102,50 | 104,08 | 105,34 | 105,28 | 105,56 | 106,44 | 106,99 |

Source: <http://www.nbs.rs>

The impact of exchange rate changes on the business was calculated according to Equation 2.2 noting that the correction coefficients are defined in relation to the estimated level of impact for the projected enterprise. For the described calculation, the value of "impact coefficient"  $k_{xyz}$  was adopted at the following levels:

$$k_{12} = k_{211} = k_{2124} = k_{234} = 1.0 \cdot \%ER; k_{211} = k_{213} = k_{217} = k_{218} = k_{219} = k_{212} = 0.2 \cdot \%ER; k_{216} = 0.8 \cdot \%ER; k_{235} = 0.3 \cdot \%ER,$$

where: % ER -changes on the exchange rate in the current month expressed in percentage. The results of operations during the three financial years 2008, 2009 and 2010 are shown graphically in Figures 2 and 3.

<sup>23</sup>Branislav Maric. „Prikaz nove grafičke metode za utvrđivanje korigovane vrednosti interne stope rentabilnosti“. Ekonomski pregled 8 no.9 (1991):463.

The values of the coefficients  $K_{xyz}$  are defined on the basis of production system assessment with the projected operations; for any other application of the model, different values of the coefficients are defined by the company management, in accordance with the structure and the specific characteristics of operation and under actual business conditions. It should be also noted that changes of operation elements are linear and proportional in accordance with the changes in the exchange rate, which is not feasible in practice. For example, in practice, workers' wages change in leaps, not linearly and automatically as in the function of exchange rate (increase or decrease). As a rule, if the balance sheet is positive, personal wages are never reduced with the reduction of exchange rate (with the strengthening of RSD). On the other hand, wages are increased in leaps, depending not only on exchange rate, but also on inflation trends. The author have opted for this approach (proportional impact on all elements of business) in order to simplify the model presentation, as well as unbalanced approach in selecting the criteria influencing the elements of operation of the projected enterprise, and the fact that the model is open, with the possibility of remodeling in accordance with users specific needs and business conditions.

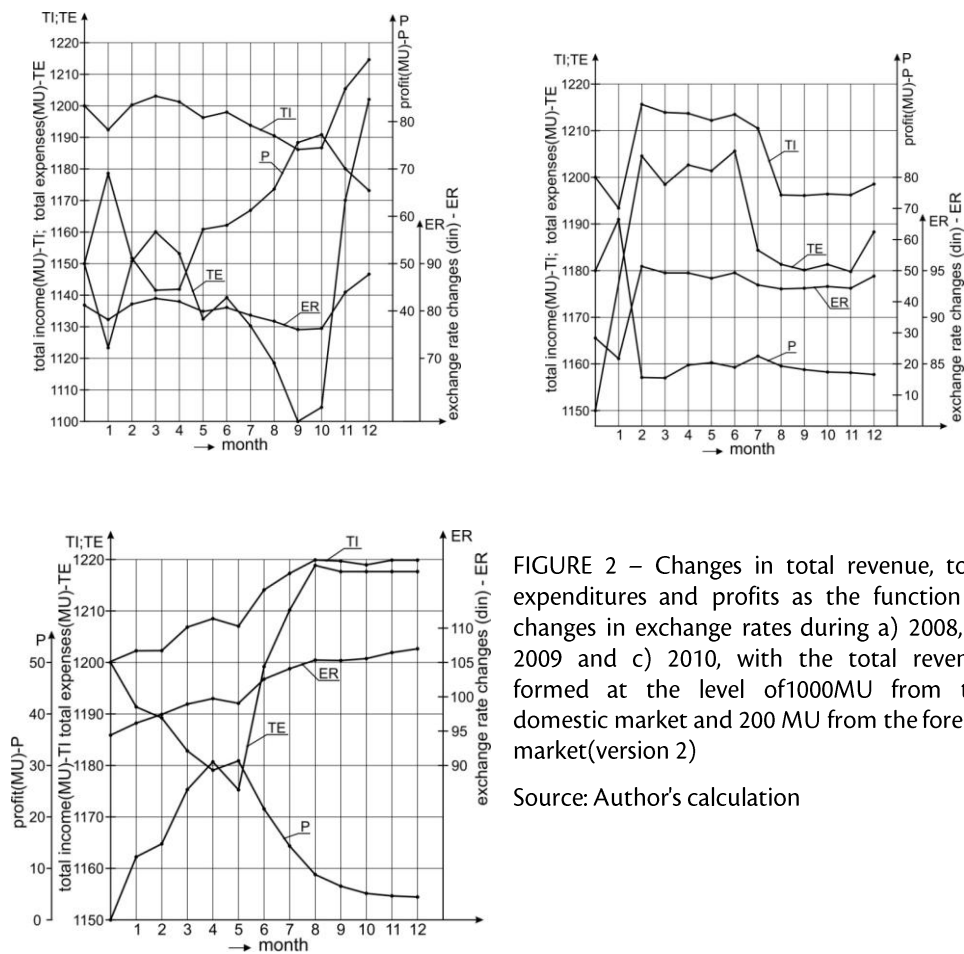


FIGURE 2 – Changes in total revenue, total expenditures and profits as the function of changes in exchange rates during a) 2008, b) 2009 and c) 2010, with the total revenue formed at the level of 1000 MU from the domestic market and 200 MU from the foreign market (version 2)

Source: Author's calculation

It is necessary to note that in the above example, the impact of exchange rate changes towards operations was calculated only as an individual element of environmental impact. In actual

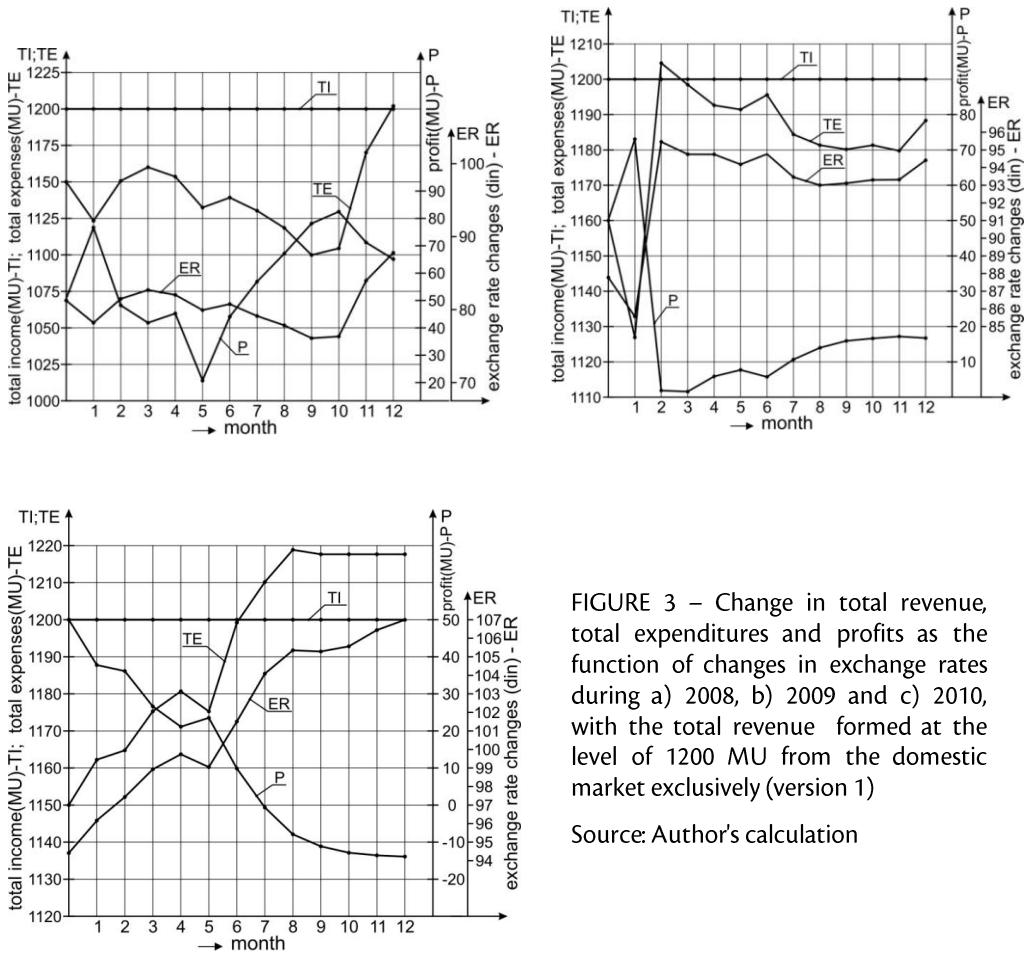


FIGURE 3 – Change in total revenue, total expenditures and profits as the function of changes in exchange rates during a) 2008, b) 2009 and c) 2010, with the total revenue formed at the level of 1200 MU from the domestic market exclusively (version 1)

Source: Author's calculation

conditions, as previously stated, the company operations depend on a whole range of influential elements that can act individually, but most often they act in combination. Indeed, the problem of operation is analyzed through combining elements<sup>24</sup>; however, to illustrate the model, only a single segment of business calculation, the impact of exchange rate changes has been shown. The same procedure can be used when calculating the influence of other impacts on the business. Based on the calculation results, the influence of any impact on business activity can be examined

<sup>24</sup>Andrea Ivanisevic, „Razvoj sistema za planiranje, praćenje i usklađivanje poslovanja industrijskog sistema u skladu sa promenama u okruženju“ (Ph.D diss., Univerzitet u Novom Sadu, Fakultet tehničkih nauka Novi Sad, 2011).

for any temporal cross-section. The influence of the impact can also be projected for the future, calculating the projection of operations and preparing the enterprise for future operations.

## V. CONCLUSIONS

The basic characteristics of the environment where manufacturing companies are operating today are the following: the processes of globalization – the dominance of large companies, highly developed product design and automated manufacturing technologies, manufacturing in huge batches, market saturated with products, shortened life time of products of defined characteristics, continuous emergence of new structural forms, reduction in difference of sales and production prices, increased labor costs and others. The company which is unable to adapt to the above influences shuts down or often becomes a part of larger production system. The company operation depends primarily on external impacts of political, economic or technological origin; however, the impacts within the technological system should not be neglected. They need to be completely eliminated, enabling the company to adjust to the external impacts. For the calculation of external and internal impacts on the operations a mathematical model has been defined. It is tested and can be adjusted to the specific characteristics of operation of individual enterprises. There is a need to introduce a feedback system in the business operations, as an extension to the mechanism of changes that is determined by the measured value of the environmental impact or the impact of internal origin

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- Web source: <http://www.nbs.rs>

## APPENDIX

TABLE – Calculation of the impact of exchange rate for the selected month – June 2010

|                       | x        | k <sub>xyz</sub> | May 2010       | June 2010                                       |
|-----------------------|----------|------------------|----------------|---|
|                       |          |                  | 99.047         | 102.507   |
|                       |          |                  |                | +3.49%  |
| <b>I</b>              |          |                  | <b>1207.05</b> | <b>1214.09</b>                                  |
| I <sub>1</sub>        |          |                  | 1000.00        | <b>1000.00</b>                                  |
| I <sub>2</sub>        | 1.0 of % | +1.0349          | 207.05         | 214.09  |
| <b>E</b>              |          |                  | <b>1175.26</b> | <b>1199.19</b>                                  |
| <b>E<sub>1</sub></b>  |          |                  | <b>818.6</b>   | <b>836.84</b>                                   |
| E <sub>11</sub>       | 0.2 of % | +1.006           | 211.47         | 212.74  |
| E <sub>12</sub>       | 1.0 of % | +1.0349          | 207.05         | 214.09  |
| E <sub>13</sub>       | 0.2 of % | +1.006           | 80.56          | 81.04   |
| E <sub>14</sub>       | 1.0 of % | +1.0349          | 269.17         | 278.32  |
| E <sub>16</sub>       | 0.8 of % | +1.027           | 62.24          | 63.92   |
| E <sub>17</sub>       | 0.5 of % | +1.0175          | 51.10          | 51.97   |
| E <sub>18</sub>       | 0.2 of % | +1.006           | 55.38          | 55.71   |
| E <sub>19</sub>       | 0.2 of % | +1.006           | 45.31          | 45.58   |
| <b>E<sub>2</sub></b>  | 0.2 of % |                  | <b>50.35</b>   | <b>50.65</b>                                    |
| <b>E<sub>3</sub></b>  |          |                  | <b>112.42</b>  | <b>114.78</b>                                   |
| E <sub>31</sub>       | 1.0 of % | +1.0349          | 51.76          | 53.52   |
| E <sub>34</sub>       | 0.3 of % | +1.010           | 60.66          | 61.26   |
| <b>E<sub>4</sub></b>  | 0.2 of % |                  | <b>30.21</b>   | <b>30.39</b>                                    |
| <b>P</b>              |          |                  | <b>31.79</b>   | <b>14.90</b>                                    |
| <b>P<sub>Gi</sub></b> |          |                  | <b>30.78</b>   | <b>21.55</b>                                    |
|                       |          |                  |                | Calculated - annual based profit, time variable |

Source: Author's calculation

The correction coefficient is calculated according to the following equation

$$k_{XVZ} = 1 \pm \frac{Y\%}{100} \cdot x$$

The adopted coefficient x for the projected enterprise:

+x<sub>12</sub> = x<sub>212</sub> = x<sub>214</sub> = x<sub>231</sub> = 1.0 · % ER; x<sub>211</sub> = x<sub>213</sub> = x<sub>218</sub> = x<sub>219</sub> = x<sub>22</sub> = x<sub>23</sub> = 0.2 · %CER; x<sub>216</sub> = 0.8 · %CER; x<sub>217</sub> = 0.5 · %CER; x<sub>234</sub> = 0.3 · %CER.



Calculation of the correction coefficient:

$$k_{12} = k_{212} = k_{214} = k_{231} = 1 + 3, \frac{49}{100} \cdot 1.0 = 1.0349, \text{ and}$$

$$k_{211} = k_{213} = k_{218} = k_{219} = k_{22} = k_{23} = 1.006; \quad k_{216} = 1.027; \quad k_{217} = 1.0175; \quad k_{234} = 1.010.$$

$$P = I_1 + I_2 \cdot 1.0349 - [E_{11} \cdot 1.006 + E_{12} \cdot 1.0349 + E_{13} \cdot 1.006 + E_{14} \cdot 1.0349 + E_{16} \cdot 1.027 + E_{17} \cdot 1.0175 + E_{18} \cdot 1.006 + E_{19} \cdot 1.006 + E_2 \cdot 1.006 + E_{31} \cdot 1.0349 + E_{34} \cdot 1.010 + E_4 \cdot 1.006]$$

$$P = 1000.00 + 207.05 \cdot 1.0349 - [211.47 \cdot 1.006 + 207.05 \cdot 1.0349 + 80.56 \cdot 1.006 + 269.17 \cdot 1.0349 + 62.24 \cdot 1.027 + 51.1 \cdot 1.0175 + 55.38 \cdot 1.006 + 45.31 \cdot 1.006 + 50.35 \cdot 1.006 + 51.76 \cdot 1.0349 + 60.66 \cdot 1.010 + 30.21 \cdot 1.006] = 14.9 \text{ MU}$$

$P = 14.9 \text{ MU}$  – profit as calculated based on temporal cross section

The calculated profit based on average annual level on the basis of time variable:

$$P_{Gi} = \frac{P_{G(i-1)} \cdot m}{m_G} + \frac{P_{Gi} \cdot (12-m)}{m_G}$$

$$P_{Gi} = \frac{30,88 \cdot 5}{12} + \frac{14,9 \cdot (12-5)}{12} = 21.55 \text{ MU}$$

## VALORIZACIJA NAJVAŽNIJIH UTJECAJA OKOLINE NA PROMJENE TROŠKOVNE STRUKTURE PODUZEĆA

**Sažetak:** Poduzeće posluje kao sastavni dio okoline i nalazi se u zavisnom položaju, kako u odnosu prema samoj okolini, tako i u odnosu na promjene unutar nje. Poduzeće najčešće nije u mogućnosti djelovati na utjecaje iz okoline pa mora razviti sustav kojim će ih djelomično neutralizirati, prilagođavati im se i usklađivati se s promjenama i novonastalim uvjetima. Razvijanjem jednog ovakvog mehanizma poduzeće treba prilagoditi svoje poslovanje najvećem broju utjecaja iz okoline i tako na kraju poslovne godine osigurati najveću moguću dobit. Ovim radom želi se ukazati na načela projektiranja modela koji bi valorizirao najvažnije utjecaje okoline i kvalificirao njihov utjecaj na troškovnu strukturu poduzeća. Na osnovi rezultata proračuna donosile bi se odluke o potrebnim izmjenama u sustavu poslovanja kako bi se rezultati postigli u okvirima koji su definirani dinamičnim planom ili, ako to nije ostvarivo, održali u području zadovoljavajućih granica.

**Ključne riječi:** utjecaj okoline, promjene poslovnih indikatora, troškovna struktura, planiranje dobiti.

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