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CONCEPT OF THE APPLICATION OF A DYNAMIC MODEL FOR BUSINESS PROCESSES IMPROVEMENT

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КОНЦЕПЦІЯ ЗАСТОСУВАННЯ ДИНАМІЧНОЇ МОДЕЛІ ПОЛІПШЕННЯ БІЗНЕС-ПРОЦЕСІВ

Метою нашої статті є використання динамічної моделі для поліпшення бізнес-процесів організації з метою досягнення гнучкості, цілісності та відповідності з визначеною стратегією. Наведено модулі, які є складовими моделі. У статті запропоновано інструменти поліпшення дії моделі.

***Ключові слова**: бізнес-процес, оптимізація, контроль, система раннього оповіщення, система цілей.*

Целю данной статьи является использование динамической модели для улучшения бизнес-процессов организации для достижения гибкости, целостности и соответствия с отобранной стратегией. Приведены модули, которые являются строящими модели. В статье предложены инструменты улучшения действия модели.

***Ключевые слова**: бизнес-процесс, оптимизация, контроль, система раннего оповещения, система целей.*

Introduction. In the contemporary conditions of increasing competition each organization is striving to better its market positions and to enhance its competitiveness. At the same time the external and internal environment factors, such as labor legislation; changes in license and taxation rates; increase of the ecological requirements, etc. have ever bigger effect on the companies. In order to address those challenges, the organizations most often resort to change of their operational and managerial structure. All that is affecting inevitably on the business processes running in the organization and is provoking the necessity of measures for their improvement. The optimization should be carried out through methods in compliance with the company structure, as well as with the selected strategy. Also the following aspects should be taken into consideration:

- "flexibility" – this aspect shows the possibility of the managing bodies to take decisions related to the strategic reorientation or revision of the goals in accordance with the changes in the environment. This stems from the impossibility of an accurate estimation or influence on the dynamically developing company environment. The business processes should have been able to be easily and quickly reoriented towards the achievement of the new goal. In order to gain sustainable improvement, it is necessary one to conform with all factors of the external (competitors, branches, suppliers and clients) and the internal company environment. Another factor necessary for the achievement of sustainability of the improvement carried out is the availability of operational improvement, which should follow the strategic reorientation.

- "wholeness" – with this aspect the existing and potential relations and interactions among all activities, processes and business processes in the organization are used in order to achieve the specified goal. Thus, the available resources are focused on the implementation of the company strategy.

- "strategic range" – all activities related to the business process optimization have to be in conformity with the company strategy. Designing on micro and macro levels is inefficient if it is not in conformity with the selected goal and strategy of the organization. In certain cases undertaking such

measures could lead to losses.

Literature research. In the present study we have used some of the existing by now literature related to building an early warning system and organizational goals design. Hahn describes the early warning indicators as tools which show presence of deviations in the company. He also explains where these indicators are defined. Gomez [3] explaining that with this system, organizations may avoid crisis which are a consequence of their functions. Hentze [7] presents some internal environment factors unlike Eversheim [2] who gives four external environment factors. Hentze [7] also review which issues have to be resolved on operational level. Hopfenbeck [8] separates indicators into absolute and relative ones. Ulrich [10] indicates when and where main company goals have to be determined. Kahl [9] and Ulrich [10] also give an example for strategic and operational organization goals. Angelov [1] adds that they are specific for each organization. The answer Why Cost Benefit Analysis is needed is given from "ACE HR services". Heinen [6] describes the main characteristic of the system of goals.

Aim of the article. The objective of the present research is to present a whole, flexible and conformed with the strategy dynamic model of business processes improvement. Also to be described and analyzed its modules, the stages to be present and the tools of optimization to be explained.

Dynamic model of business process improvement. The proposed dynamic model of business processes improvement is constructed of three modules: "Early warning system", "Business processes optimization", and "System of goals". For each module, the stages and tools that build it have been described and analyzed.

Module „Early warning system". The early warning system is built and functioning through early warning indicators. The presence of a deviation thereof is a signal for the company management to undertake actions and/or measures, whereby to carry out the necessary correction [4, 25]. Reading the changes of the early warning indicators parameters gives the companies the opportunity in due time:

- to identify the possible risks they are facing;
- to reveal hidden potential;
- to identify their strengths and weaknesses.

That way, each organization has the possibility/chance to avoid or prevent dangers, consequence of its existence [3, p. 11]. Further, it is acquiring flexibility towards the occurrence of adverse events. The actions for dealing with those dangers should be in conformity with the selected strategy.

„Early warning system" module is built in two stages. Firstly, an analysis is made of the external and the internal environment of the organization, factors and zones of monitoring are defined. The early warning indicators are defined from the information of the analysis.

"Analysis of the internal and external organizational environment". At this stage the potential sources of damages or benefits for the organization are described and analyzed, notwithstanding whether they are beyond or within the corporate borders. The analysis is focused as on the peripheral, as well as on the internal environment of the company. The effect of factors is reported, such as: reasons for the occurrence of technological breaks; what the ecological norms are by the moment for the branch and their future changes; existence and significance of future economic forecasts [7, 223]. They define the monitoring zones, which are directed towards comparison with the direct competitors, but they are also in conformity with the company goals. The external corporate environment is an aggregate of factors and elements, which are not part of the company, but are affecting it. Such are the factors of the social, economic, political and technological environments [2, 10]. The changes in the environment influence strongly the organization, but its effect on them is limited. At the same time, business processes run within the internal environment frames, but with the presence of external customers. This is the reason the designing and improvement of each business process must be in conformity with the company internal and external environments factors. The objectivity of the analysis requires considering the internal and external environments factors (table 1). What is more, it will help also the accurate formulating of the indicators in the following stage.

Table 1.

Environment factors

Internal environment factors	External environment factors
✓ Product	✓ Social system
✓ Order	✓ Economic system
✓ Resources	✓ Political system
	✓ Technological progress

„Identification of the early warning indicators". The early warning indicators are developed on the grounds of the information obtained from the first stage. They are tools detecting as earlier as possible the changes in the internal and external environments, which affect the realization of the company goals. The indication for the occurrence of such changes appears in the already specified zones of monitoring [5, 266]. A specific value is determined for each indicator in order to report its current status in the company itself against its direct competitors. Slight deviations from the values of the indicators can be detected by it. The indicators itself divide into absolute – reporting the status at a particular moment and relative – tracking changes for a given period [8, 633]. The relative ones could describe a relation, a correlation or an index. The monitoring is done periodically or continuously and the indicators may be changed in accordance with the company goal. The monitoring periods, which are specific for each company, are determined. They can be in compliance with the product's life cycle. Also, the admissible deviations for each indicator are specified and control limits are set forth. They depend on the minimum level of profit for the company specified in advance. Upon reading a value of an indicator beyond those limits, a signal is sent measures to be taken for the improvement of the relevant process. Also, adjustment of the monitoring period is allowed.

„Functioning of the early warning system". The system functioning is performed through monitoring of the company and the environment. This process can be described as a sequence of six steps. It starts with research of the organizational environment (subsidiaries, direct competitors, indirect competitors, companies located in other branches, etc.). At the second step the early warning indicators are specified, specific values of each indicator are chosen and limits of tolerance are elaborated. Third step: the information obtained from the first step is compared with the data of the organization and is presented as spider web diagrams. In case of deviations from the indicators in the third step, an analysis is done of the reasons of their appearance at the fourth step. At the fifth step the forecasting and evaluation of the discovered deviations is done. Finally, an adjustment of the process parameters is carried out and the decision thereof is within the competence of the managers.

Module „Business processes optimization". Through the "early warning system" module, by comparing the organization with its direct competitors or companies with similar organizational structure, its position in the branch by that moment is determined. The goal of the improvement is the overcoming of the ascertained difference in favor of the competitors. The main task of „business processes optimization" module is not only to achieve, but also to surpass the envisaged goal. The methods and tools thereof are divided into strategic and operating levels of organizational management. The main goals are specified at the strategic level [10, 114]. They are not delegated and are specific for each organization [1, 7]. On the operational level the stress is put on the solution of current problems and the achievement of individual goals [7, 55].

Essence of optimization. In the „business processes optimization" module at strategic level the "ideal" goal of each process is specified. It should be in conformity with the internal and external environments of the organization. The goal on operational level is conveyed to the department managers and they, together with their subordinates, evaluate the possibilities of its realization. Technical, monetary and human factor assessment is performed. For this purpose the Cost Benefit Analysis is used, since it is widely used for taking a decision related to the change [11, 1]. Should the analysis show that the "ideal" goal cannot be achieved, the department managers make adjustments therein. Upon presence of such a problem in other sectors, the same procedure is applied and all modified goals are referred to an "optimized" process. It is compared with the target process and should it be better or equal measures are taken of its implementation in the enterprise. In the opposite case, further optimization is needed and the already described actions are repeated. In case the improvements reach the idealized common goal, the personnel is familiarized with the concrete

actions and measures of their achievement.

The main idea of the model is based on the possibility of presenting a real business process as a vector. To that end the real processes are presented in strongly aggregated form. This way the entire company could be depicted by a single vector. Its coordinates should correspond to the parameters of the real business processes. The vector's length corresponds to the sum of the parameters of all processes within the organization. The aspects of improvement form the coordinate system axes. Theoretically, improvements are possible in n-number of aspects, but in the practice, in order to facilitate the visualization, only two or three aspects are used.

Methods of vector presentation of processes. With the dynamic model of business processes improvement, the mathematical rules of vectors calculation are used. Prior to proceeding with the processes improvement stages, one should consecutively perform the following steps:

Step 1: Consecutive presentation of all processes in the organization. This is necessary for two reasons: clarity of visualization and overall assessment of the process before improvement.

Step 2: Identification of the monitoring range. It is specified by the needs of the researcher and depending on the selected vector size.

Step 3: Collection of necessary data. All data used should be generated by one and the same source. Where a process is passing through different departments, each department is generating information. It is collected and evaluated. Also, the dimension of the examined units should be the same.

Step 4: Classification of parameters. They are divided into positive and negative. Upon improvement, the positive ones should be increased and the negative ones should be reduced.

Step 5: Determination of collecting and non-collecting parameters. The collecting parameters are those, which individual vectors can be added in absolute dimension and real values can be calculated. The non-collecting parameters are calculated in relative dimension, but their individual components are in direct relationship with the business process.

Step 6: Specification of the number of axes in the coordinate system. The number of axes depends on the selected number of observations. Each axis is named according to the parameter used.

Step 7: Transformation of the real business process into a vector. Each activity of the process is presented as a vector. Its starts from the zero point of the coordinate axis. The vector's end is marking actually end of the activity. The starting point of the next activity is the end of the preceding vector. The vectors' lengths and directions depend on the actually measured values for each activity.

Step 8: Calculation of the common vector. The vector resultant is calculated, which is the sum of all vectors corresponding to each activity.

Step 9: Calculation of the individual components' weight. The separate components can be weighed depending on the selected objective of improvement.

Optimization model. Actual improvement of the critical business processes is done through the optimization model. The steps of optimization are defined, as well as the necessary improvement tools.

The already defined "ideal" goal should be presented as a vector. This is performed by drawing a vector from the beginning of the coordinate system to the point of ideal goal's visualization. It is called a target vector and is compared with the resultant vector obtained by the vector calculation model.

Step 1: „Determination of processes efficiency"

At this step the efficiency of the existing process towards the goal one is calculated. This is done by comparing the resultant vector with the target one. In case of any deviation, we can calculate by how much the values of each composite vector (each process) should be improved in order to achieve the "ideal" goal. The measuring unit of the efficiency is the coefficient of "common efficiency". It is the difference between the positive and the negative efficiency coefficient. The quotient of the positive components towards the resultant vectors is the positive efficiency coefficient. The positive components are the ones that should be increased through the improvement and the negative – those that should be decreased. The negative efficiency coefficient is the quotient of the negative components of the target vector towards the resultant vector. With common efficiency coefficient bigger than zero – the target vector is bigger than the resultant one (the target process is better than the real one), and vice versa.

Step 2: „Determination of the improvement potential"

At this stage of optimization a comparison is made between the sub-processes of the real and the target processes. This is done by comparing their composite vectors (partial vectors). The vectors building the common vector of the real process correspond to the values and the number of the real sub-processes in the organization. The data of the number and parameters of the components building the target vector depend on the collected information quantity. In case of lacking such information, "ideal" partial vectors are defined. The comparison between the partial vectors of the target ones and the real vectors is done at a given point. Each vector's components correspond to actual numerical values for each process. For that reason, the partial real vectors are deducted from the partial target vectors and a new resultant vector is formed. It is corresponding to the goal of improvement of each individual process. If any of the partial vectors which formed the new resultant vector is less than zero, then the real process is more efficient and vice versa.

Step 3: „Determination of improvement priority"

Adding a priority for the performance of the optimization is a supplement to the second step. Thereby, information is obtained about the need of improvement of each sub-process, but not about the order of application of such improvements. The determination of the optimization priority is done by analogy of the first step. The positive and negative values of the partial target vectors and the resultant vectors are compared. In this case the difference between them shall represent the single efficiency coefficient. With coefficient values bigger than zero, positive components are prevailing in the partial vectors. Despite that the target vector is more efficient than the resultant one, optimization is not needed. The relations between the positive and the negative components of the partial vectors can be presented in five classes. The first two classes characterize cases where the positive components are more than the negative ones. In such cases the improvement priority is very small. In the other two classes the relation is reversed and there the need of optimization is big. In the last case, the positive components of the partial vectors are equal to the negative ones. In such case the resultant and the target vectors are one and the same.

Step 4: „Determination of target vector parameters"

At this step the target vectors are analyzed and evaluated. Until the moment of comparing with the real process, a target vector is used, which is depicting an "ideal" target process. It is assumed that it was built of a certain number of sub-processes (partial vectors). The individual vectors have equal length, i.e. they are ideal partial vectors. There is lack of information about the ideal process. No one knows whether the number and the duration of the sub-processes of the "ideal" process are coinciding with those of the real one. This information can be obtained through the early warning system or other specialized sources. The more this knowledge is, the more accurate description of the target process can be obtained. The target vectors evaluation is divided into three cateories. The first category is "evaluation of vectors' components". There the components of at least one partial vector are known. "Evaluation of vectors" is the second category. Here information about an actual partial vector is missing, but the resultant is known. The third category is performing a "factor evaluation" of the target vector. The goal is known, but the separate sub-processes (partial vectors) are unknown. The factor evaluation can be linear, nonlinear or combined. The practice shows that clear distinguishing of the factor evaluation is difficult to obtain, since the information about the factors depends on the subject of the research.

Step 5: „Application of improvement tools"

The goal of the fifth step of the business processes optimization of the model is implementation a set of tools to be applied, through which the real critical process is transformed into a target one. The proposed tools are based on two geometrical principles – rotation (spinning) and translation (shifting). The shifting could be expansion or shrinking of the processes. The rotation of processes is allowing changing the components building the business process without leading to its prolongation. The expansion is applied on a process, which should be "slowed down". Thus resources are freed for the organization. On the contrary, the shrinking is shortening the process and is applied where one process "stops" the running of the entire process chain. From those geometrical principles, seven tools of improvement could be derived:

- ✓ Acceleration – reducing the duration of one or several processes.
- ✓ Parallelism – a special case of acceleration. The critical process is divided in half in order to

increase the total efficiency.

✓ Elimination – one or several processes are eliminated from the entire business process. The elimination could be reversible or irreversible.

✓ Unification – joining and unifying two or more processes in a new process.

✓ Change of sequence – the change of sequence of the processes is aimed at smoother running of the process chain and release of synergy potential.

✓ Automation – could be described also as a special case of acceleration. This way the business process is stabilized and is hardly affected by external influences.

✓ Adding a process – integration of a new process to the existing process structure. Depends on the selected depth of production in the organization.

Step 6: „Evaluation of the improvement result through simulation"

At step six an imitation of the organization and its processes is performed, aimed at actual application in the practice of the achieved results. Bettering of the real process and its approximation to the common goal is simulated. The identification of an inefficient process through monitoring is accepted as the beginning of the simulation. In each department of the company, through the use of various scenarios, a comparison is made of the various alternatives of achieving improvement. The best of them is compared with the partial "ideal" process and the result is submitted to the department preparing the strategy. In this department the deviation from the common goal is determines on the grounds of the results of the remaining company units. The simulation process can be repeated in order to gain more stable parameters of the improvement.

Module „System of goals". The "system of goals" module is reviewing the aggregates of goals in the organization [6, 45]. Its building passes through tree steps. At the first step the main company goals are defined. Most generally they are: quantitative, value and social. At the second step sub-goals are added to each objective: financial goals, productivity, social goals. Each of the sub-goals is concretized by indicators at the third step. They show the purpose of improvement in each unit. On the other hand, those strongly concretized sub-goals are used for recording the deviations of one's own company towards the direct competitors in the early warning system. Further, the goals and sub-goals set forth for achievement are elaborated with great accuracy and are quantitatively measurable. They are allocated into all hierarchic levels in order each worker to be familiar with the goal that should be achieved by his department. The early warning system is making periodical comparison between the company indicators and the external environment, which is serving for adjustment (if necessary) of the level of achievement of the main goals [9, 202]; [10, 97].

Conclusion. The presented dynamic model of business processes improvement is based on the comparison of strongly aggregated company business process with an "ideal" target process. The difference of the juxtaposition represents the improvement potential. Because of the flexibility of the model, simple and complex processes can be improved, as well as separate processes within the business process. The improvement is carried out under the described method by using deductive techniques. The parameters, under which the optimization is done, may be n-number depending on the necessity. The dynamic model is characterized by: simplicity of calculations; integrity of the performed improvements; visual presentation of complex processes and resources used; periodicity of monitoring and timely decision of optimization, as well as opportunity of strategic alternatives evaluation. The implementation of the proposed method allows the achievement of stable parameters of optimization combined with low expenditure of company resources.

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