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PROCESS APPROACH TO THE EVALUATION OF INFORMATION SYSTEMS EFFECTIVENESS

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In the article the concept of using the process approach to assessing the effectiveness of information systems is presented. This method focuses on information systems supporting core business activities. An important feature of the concept is to extend the assessment of both the systems – the information system and the production system, which are linked together by a common process models.

Keywords: process approach, information system, economic effectiveness

1. Introduction

Globalization and technological progress are associated with the need to gain and maintain a competitive advantage, including through the use of modern information systems supporting management systems. Firms often incur large expenditures on information systems. It follows an interest and a need to assess the economic effectiveness of such systems. There are many methods to evaluate the economic effectiveness of innovative solutions described in the literature, including IT systems. These methods are often a subject of criticism. Their use in practice faces many problems such as the assessment of effects on the side of system user (receiver).

In the article a process approach for evaluating the effectiveness of information systems will be presented. Main (as verified by us) area of its application

covers the IT systems supporting core businesses, which results are addressed to specific recipients, and are the subject of the sale. A typical, though not the only, example of this are MRP II / ERP and SCM systems, in particular their production management, procurement and distribution modules etc.

The scope of the evaluation of the new method includes both information system and production system (incl. logistics, etc.). The first one is treated as a supporting system, while the other as a system to be served. Key to the new evaluation method is mutual relation of the two systems. Both systems are linked together through a common process models, which on the one hand create a specification for this information system while on the other hand these same processes are models (description) of production systems.

2. Effectiveness evaluation

Economic evaluation of IT projects is very important due to the very high financial investments, and the associated risks. This applies to both implementing and the user companies. There are more than 60 different methods to assess the economic efficiency of information systems described in the literature. New methods are arising constantly, which are often a compilation of existing ones.

While from the point of view of implementing company it is usually much easier to evaluate the effectiveness of the implementation of the information system so far from the user's perspective it is not that simple. Introducer is aware and knows what benefits can be expected even on the basis of his earlier experience. It can also determine the timing and human resources needed to be involved in the implementation of the project. Nevertheless, implementing company bears also the risk and should carry out analysis of the potential risks associated with the customer to withdraw from further cooperation.

From the user's perspective much more important is the economic assessment because he is the one, who invests large amount of money to buy the equipment, prepare the infrastructure, purchase of software licenses, external consultation, staff training, staff time devoted to the implementation work, additionally should be consider inadequate system selection, inadequate understanding of the needs, a failure of organizations to change, errors resulting from underdevelopment of the solutions, the errors arising from ignorance of the new solution once it has started, and many others. Large IT systems, and these are certainly ERP systems are not only expensive, but also affect the way of functioning many areas of the company. In addition, evaluation of the effectiveness is complicated by the fact that the effects of the implementation appear to be completely separate from the expenses were incurred, and often it is difficult to correlate them with each other. Moreover, there are also intangible benefits, which further complicates the assessment of the information systems [7].

The biggest problem with the defining the effectiveness of IT solutions is not only a problem with the presentation of a tangible benefit, but also the fact that very often the majority of the data needed for such statements is not recorded at all.

Judgements concerning effects that are immeasurable often result from confusion caused by the incorrect interpretation of the properly measured object, the wrong idea of measuring, the wrong way to measure (e.g. improved access to information can be expressed in figures or in amount in the form as a faster time to obtain information).

3. Process approach

Describing the process approach, it is necessary to focus on the key word which is a process. The process according to ISO 9001:2008 terminology is defined as a set of interrelated or interacting activities, which transform inputs into outputs. The actions require the allocation of adequate resources such as people, machines, materials, tools, information, energy, etc. [4].

The general division of the processes due to the gradation of the aims and objectives of the system was proposed by S. Chajtman. He distinguished three groups of processes [1]:

1. main (basic) processes – fulfilling key tasks of the system, by providing to the environment products, which are the main output of the system,
2. supporting processes - to ensure and maintain efficiency of tools, equipment and human labor in all processes,
3. information and control processes - that reflect and control the interfaces between parts of processes, these processes most commonly are defined as the processes of managing and overseeing.

These three groups of processes are closely linked together with clearly defined relationship, which shows Figure 1. Elements of ancillary processes are supporting basic as well as management processes. However, elements of information and control processes are closely connected with the basic and supporting processes. In the era of increased globalization effective management of business processes is becoming increasingly important to every organization.

Process approach according to ISO 9001:2008 means the systematic identification of processes and their mutual correlation and appropriate management in order to achieve the desired result. Process approach is an effective way to organize and manage activities to create value for customers and other stakeholders. Process approach introduces horizontal way of management, exceeding the boundaries between different functional units at the same time focusing attention of these cells on achieving the main objectives of the organization [4].

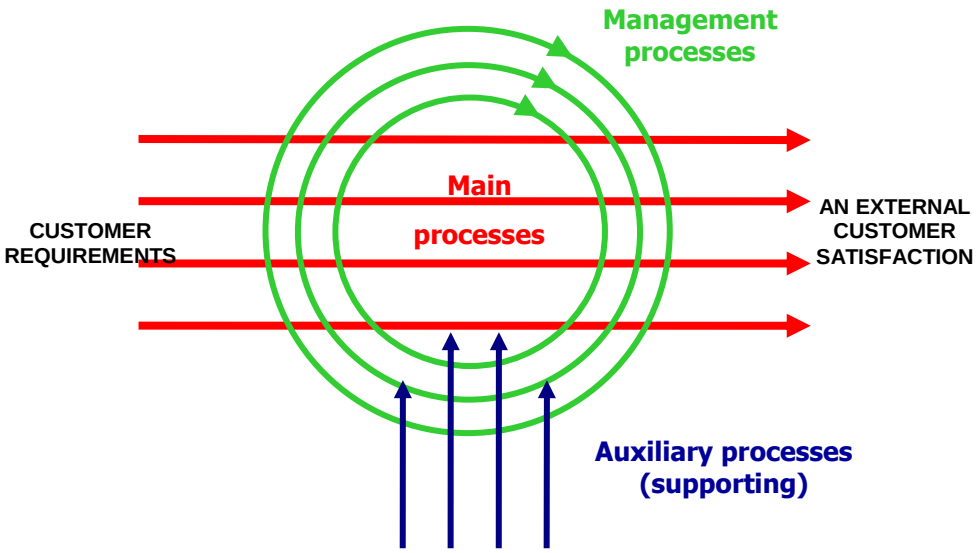

Figure 1. Types of bussines processes. Source: [3]

Process approach is successfully used in designing and implementation of information systems in the organizations can also be used to evaluate the effectiveness of these systems.

4. Information system and production system

The use of new IT technologies to improve processes was often reduced to automation and / or acceleration of the individual elements of the existing process. This creates problems of communication between processes, and makes it difficult to acquire and process data. Quite common practice was to equip and develop separate IT applications in different business units. The use of separate systems, often running on different hardware platforms with different data structures were aimed at optimizing internal performance. Nobody analyzed the total organization and no one was responsible for the processes as a whole. Today, these companies are facing with the problem, which is the integration of the different parts of the process into one coherent whole.

Most of the processes in large corporations have not been subject to detailed analysis and any changes at all. In fact, many current processes are the result of a series of ad hoc decisions made by the functional units that do not pay attention to the efficiency and effectiveness of the whole process. Many processes have never been measured. There are often not examined the entire process, only parts carried

by separate entities. Individual departments optimize their performance, which is not reflected in the improvement of the whole process.

Analysis of information technology should take into account how it supports the business processes of the organization. However, thinking about business processes and streamlining them should be carried out having in mind opportunities that information technology can provide.

The relationship between information technology and business processes can be viewed as a recursive relationship [2].

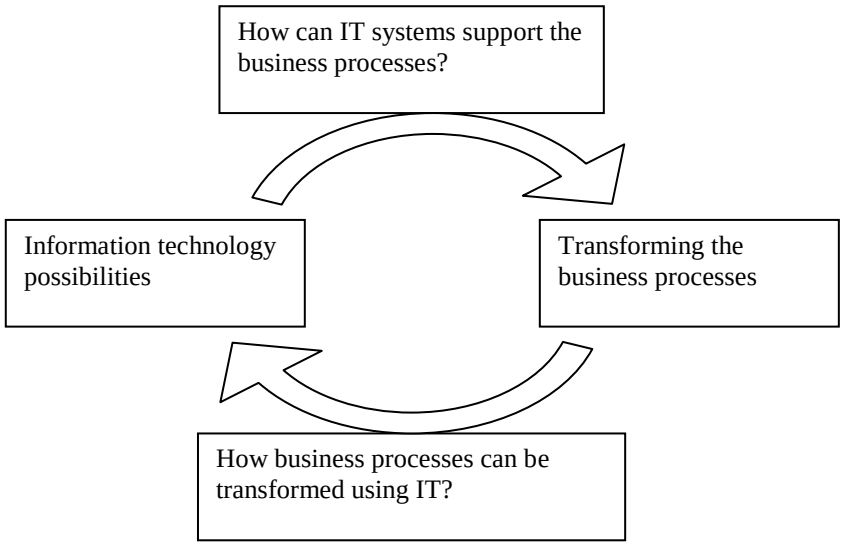

Figure 2. Dependence of information technology and processes. Source: own preparation on the basis of [2]

In this article we will define the system as a set of elements extracted from the environment due to the realization of a particular purpose. In this paper, we focus on production and information systems. Both systems work closely together, supplying each other with data. However, there is a different nature of these tasks. The information system is a system which provides services to the needs of the production system, that is why it is treated here as a supporting system, while the production system is being serviced and supported.

The production system is deliberately designed and organized as configuration of material, energy and information flows used (controlled) by humans in order to produce certain products (goods or services) to meet the diverse needs of consumers.

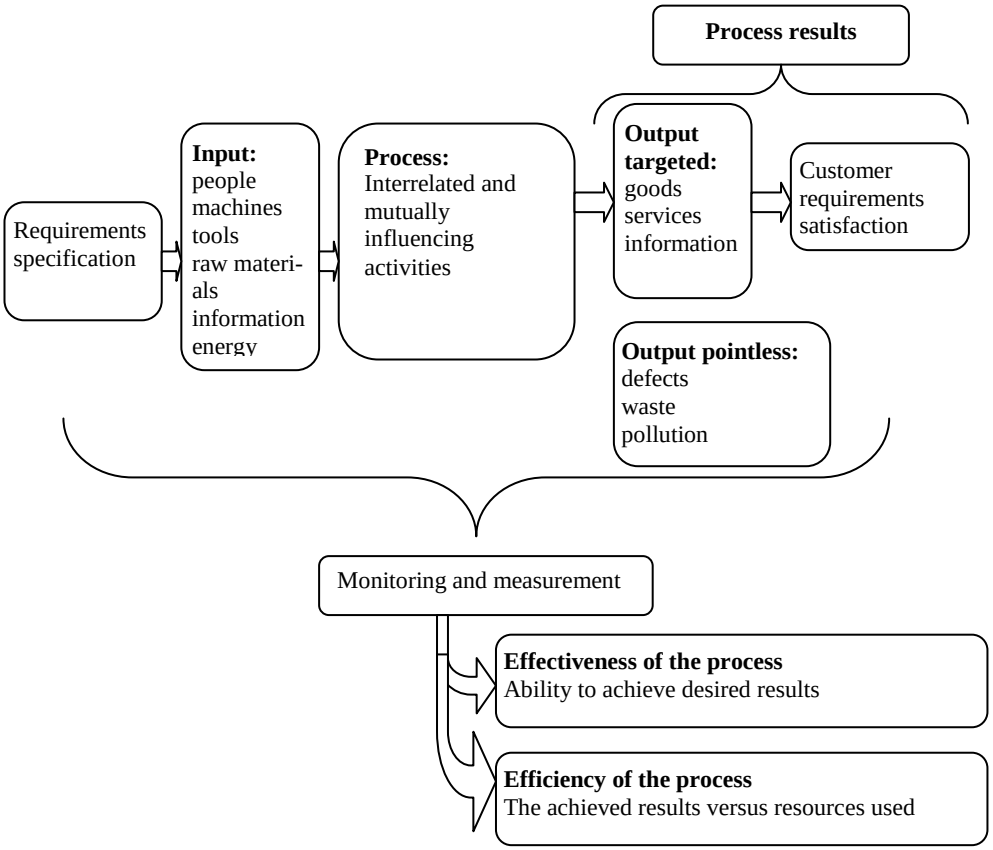

Figure 3. General process model. Source: own preparation on the base of [4]

The information technology system is defined as an information system that performs its task using IT tools. The information system is a set of elements, extracted from the environment, in the form of data elements, the method of collection and processing, storage and transmission these data using variety of channels and people [6].

Simplifying, it can be said that the information technology system is based on the transmission of information using information technology. However, it should be noted, that the information technology system is responsible for not only providing information, but also for supporting business processes and decision making [5].

Diagram of connections and relationships between the various elements of the information technology system is presented on the Figure 4.

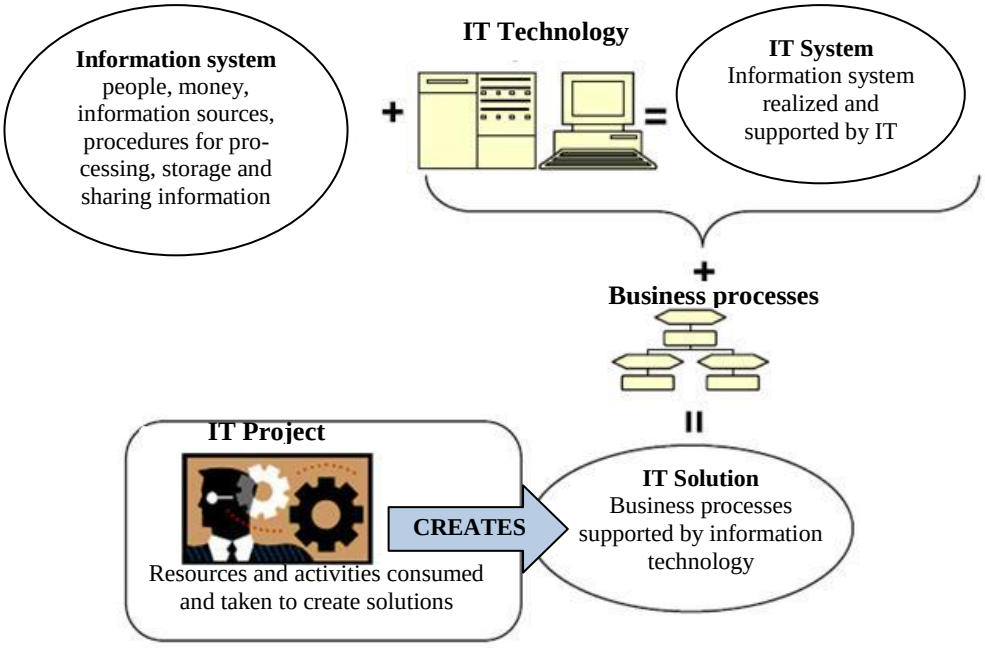

Figure 4. Formation process of IT systems. Source: [5]

Relationship between information systems and business processes are indisputable. Therefore, it seems to be unnatural to consider and evaluate separately information systems and production systems that execute business processes.

The relationships between information system and production system is explains at Figure 5. The production system is fed input streams, which include information from the information system, and which are necessary for the proper functioning of the system serviced – operated. However, the output stream of the production system in addition to physical products also includes feedback to the information system, which without this information can not properly operate and provide services to the needs of the production system.

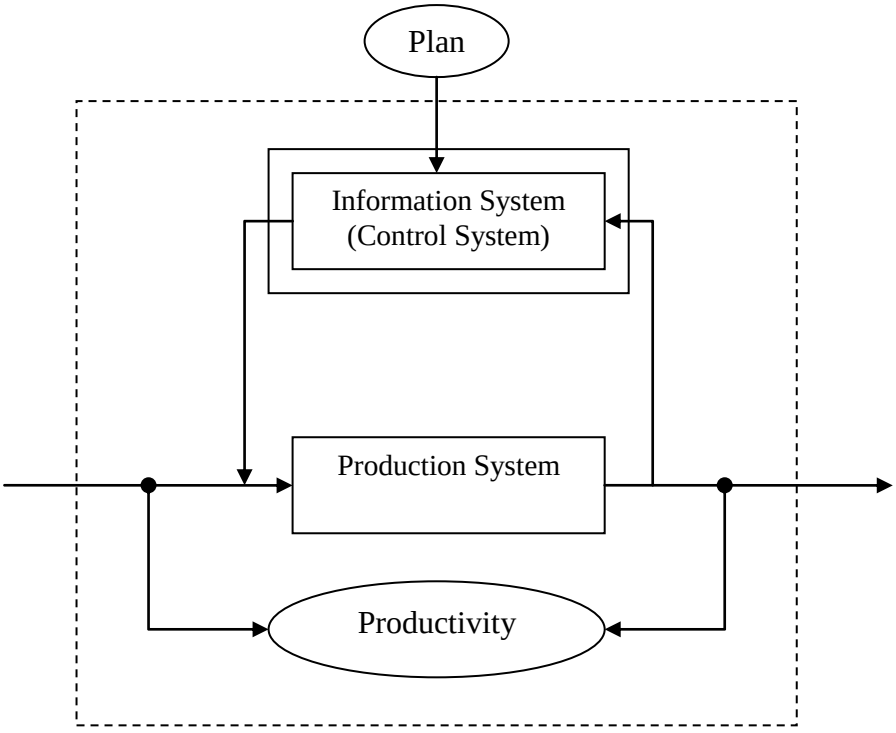

Figure 5. Interdependence of the information system and the production system

5. A new method to evaluate the effectiveness of it systems

The new method is based on the process approach combined with the selected method of assessing effectiveness. The method will be exemplified of ROI (Return on Investment) although any other effectiveness measure can be used. The method consists of several steps, which in part can be executed in parallel and partially sequenced.

- Mapping the current state processes, dimensioning processes – assessment of the initial situation.
- Analyse and improving processes.
- Modelling of the target state, dimensioning process - assessment of the future situation (ex ante).
- Designing DuPont scheme for ROI.

- Developing a matrix representing relationship between processes and DuPont diagram for ROI.
- Analysis of changes in the individual partial indicators.
- Analysis of the impact of the change sub-indices for the main indicator of economic evaluation effectiveness.

The first step is to identify key processes and their decomposition into elementary processes and sub processes. This can be done by using pattern (reference model) of such classification processes developed e.g. by SCOR or APQC. An example of the result of processes decomposition is shown in Figure 6.

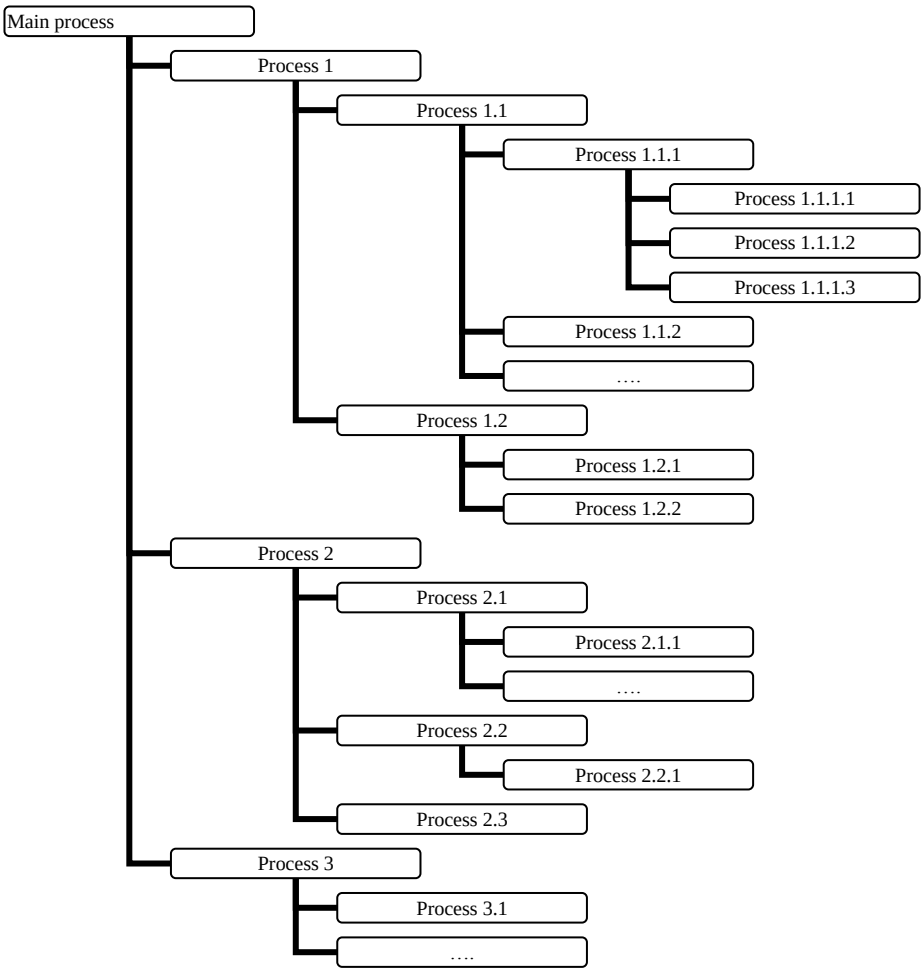

Figure 6. An example of decomposition processes

In the next stage of the method, processes describing the current state should be verified, paying attention to the processes which are stored in the computer system if they are compatible with the processes carried out in reality. On this basis it is possible to build models of processes in the target state.

In parallel to steps presented above a decomposition of general measure ROI on elementary factors shall be performed. For this purpose, it is proposed to use the DuPont chart. It is widely known and used for a long time including to analyze the ROI. This scheme has been designed by an engineer, Donaldson Brown, working for the of DuPont in the 1920s.

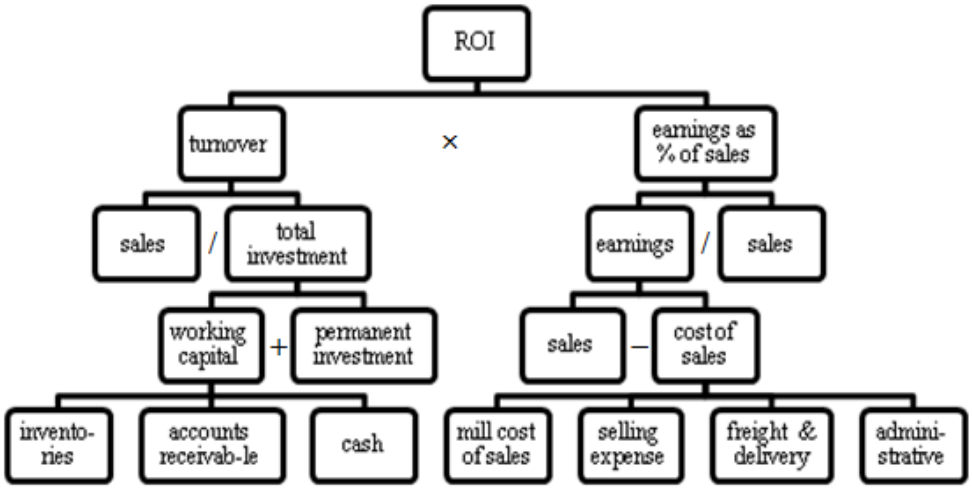

Figure 7. The chart of F. Donaldson Brown's return on investment formula.
Source: based on [8]

Diagram presented on the Figure 7 can be developed (in a more detailed way) in any manner consistent with the specific needs and conditions (in particular: effectiveness measure).

The next step is to develop a matrix of relations between the described processes and DuPont chart showing the ROI. Thanks to this matrix it is possible to study relationships and the impact of changes in individual elementary processes on the value of the sub-indices and the main index. Possessing the results of the evaluation of such processes, it is possible to associate the effects and expenditures related to them, with the corresponding partial measures.

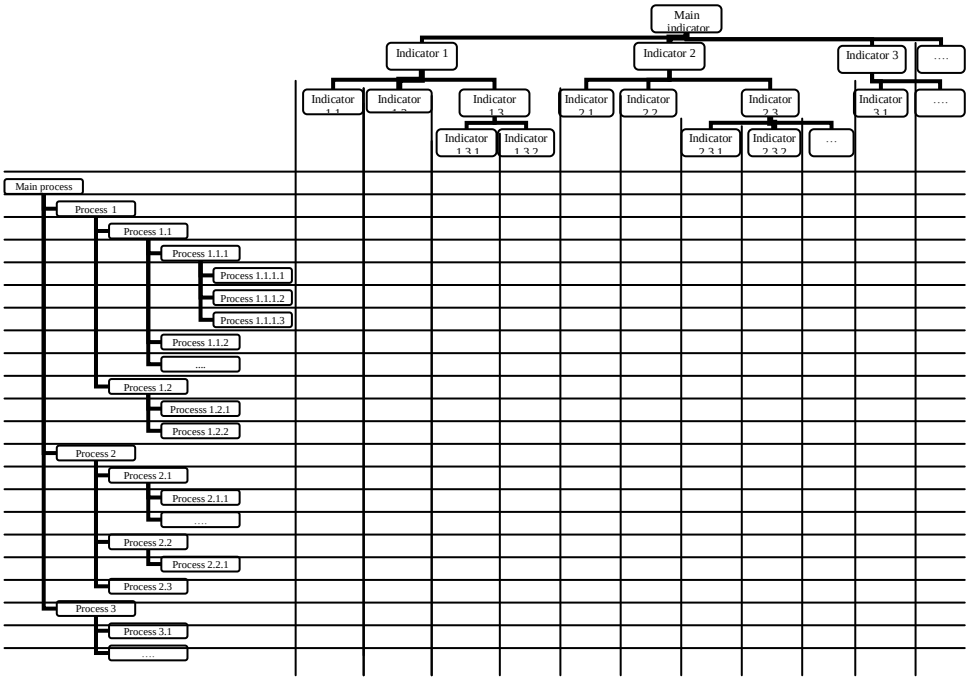

Figure 8. Matrix representing relationship between processes and DuPont chart for ROI calculation

The application of a process approach in conjunction with the Dupont diagrams allows easy implementation of a number of methods to assess the economic effectiveness of information systems. The article presents an example of the application of the method to calculate ROI. Directions how to use the method with other measures of economic effectiveness evaluation are very similar.

The new method allows the identification the basic types of expenditures and effects, and clear assignment them to the processes supported by the information system and on the other hand, to particular locations in the production system, where data concerning costs and effects can be collected.

The method allows conducting simulations of various conditions for projects enabling the sensitivity evaluation of indicators to assess results of changes in project parameters as well as in the production system. The way of calculation effectiveness indicators can be easily implemented by using a spreadsheet.

This method can be used to conduct evaluation ex ante and to assess the current situation – during the implementation of the information system. The gradual implementation of the information system interferes with processes carried out by the production system. Owing to this new method it is possible to assess the impact of occurring changes. Additional advantage of the method is the ability to evaluate

how the implementation of the information system will affect the parameters that characterize the functioning of the whole production system.

6. Conclusion

The method is a partial result of the project "Application of the Theory of Constraints in IT Project Management" supported by the grant no 6ZR10 2008C/ 07128 conducted in the Institute for Production Systems Organisation in 2009-2011 by the research team under guidance of prof. Krzysztof Santarek [7].

Initial studies suggest that the method is highly effective. It allows simulations (ex ante) the economic effectiveness, the study of sensitivity evaluation indicators caused by changes of system parameters (e.g. delays in the implementation of the system, budget overruns, not achieving assumed operational parameters, etc.). The essence of the method was explained on the example of the ROI measure, although it can also be used in the case of other measures of economic effectiveness assessment. An important advantage of the method is the simplicity of its implementation, e.g. using a spreadsheet.

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