

Computer Simulation in the Management of Business-Processes

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Abstract¹

Contemporary methods of business-process management are based on using conceptual modelling tools that visually demonstrate resource and information flows movement in business processes. In this paper authors suggest analyzing efficiency of these methods with computer modelling of quantitative business-process characteristics which help determine most efficient methods to improve these characteristics. The main aspects of implementing PowerSim Studio 2005 simulation method to the business-process performance-based management are discussed. The correlation between strategic goals and business-process measures is analyzed and methods of business-process management that helps the organization to pursue its strategy are modelled. The reasonability of simulation method implementation in commercial organizations and its efficiency is shown.

1. Introduction

Traditionally managers use the management approach of strategic development based on financial measurements. In knowledge-based competition, the ability of organisation to develop, nurture, and mobilize their

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intangible assets is critical to success. But financial measurements could not capture the value-creating activities from an organisation's intangible assets. Intangible assets seldom affect financial performance directly. Instead, they work indirectly through complex chains of cause and effect. Balanced Scorecard is proposed as the solution to this performance management problem [2].

The correlation of such an intangible assets measurements as business-processes measures is possible to establish using the computer simulation. In this article authors give an approach of building a business-process management system based on Balanced Scorecard using a computer simulation.

2. Company as the Object of Analysis

Using the system approach, a company is considered as the object of analysis. The main goal of a company is measured by financial measures and it is quantitative. The strategy of organization is a system of strategic goals and activities to meet them.

2.1. Determining Company's Goals

Traditional approach of strategy development based on financial measures that determine strategic goals. The addition of intangible assets measurements lead to the creation of new concept called the concept of measuring achievements. This concept includes Performance Management Model, Performance Pyramid, Ernst & Young and Hewlett Packard measurement systems, EP2M model of C. Adams and P. Roberts and Balanced Scorecard [3,4]. Each system has its own advantages and disadvantages but the analysis based on integrity and applicability criterions lead to the conclusion that the multi-purposeful and the most common Balanced

Scorecard [2] is the best system to measure the company's performance.

Balanced Scorecard translates the company's vision and strategy working from four perspectives: financial perspective, customer perspective, business process perspective and learning and growth perspective. For each perspective of the Balanced Scorecard four things are monitored (scored):

- Objectives: major objectives to be achieved, for example, profitable growth.
- Measures: the observable parameters that will be used to measure progress toward reaching the objective. For example, the objective of profitable growth might be measured by growth in net margin.
- Targets: the specific target values for the measures, for example, 3% annual decline in manufacturing disruptions.
- Initiatives: project or activities to be initiated in order to meet the objective.

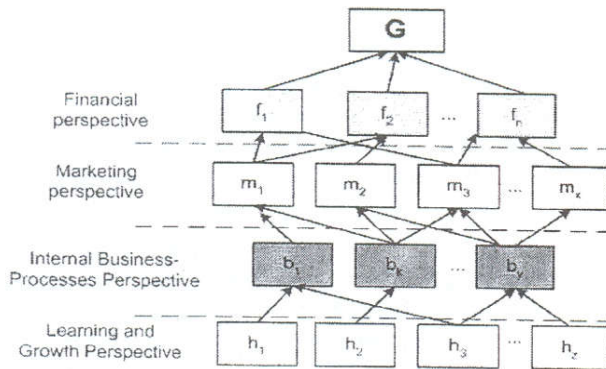


Figure 1. The Tree of Objectives

The difficulty of Balanced Scorecard implementation is in the fact, that measuring the influence adequacy of each of the qualitative and quantitative measures in management system is a base of formulating the strategy. That is why the set of measures in Balanced Scorecard determined by company's strategy and vision.

Authors suggest selecting the strategy from the set of strategies by using content rules. These rules apply to company's environment and internal capabilities. The company's environment assessed by analysis of company's life cycle stage that made on the basis of business market share, investment, and profitability or cash flow and competitive position based on the following criteria: dominant, strong, favourable, tenable, and weak. The internal capabilities analysis based on measures in the following Balanced Scorecard perspectives: finance, marketing, internal business-processes, learning and growth perspective.

As a result of content rules analysis from 16 strategies selected the most appropriate strategy of set of strategies. Each strategy determines the goal tree, consisted of

strategic goals in finance, marketing, internal business-processes, learning and growth perspectives.

2.2. Organisation's Performance Measurement Model

To build a strategic management system, it is necessary to create a mechanism that makes company managers implementing the strategy. The Balanced Scorecard suggest use strategy map that describes the process for transforming intangible assets into tangible customer and financial outcomes [2]. Strategy map determine the logic of strategic goal achieving because measures embedded in a chain of cause-effect logic that connects the desired strategic goals with the activities that will lead to the strategic outcomes (Figure 2).

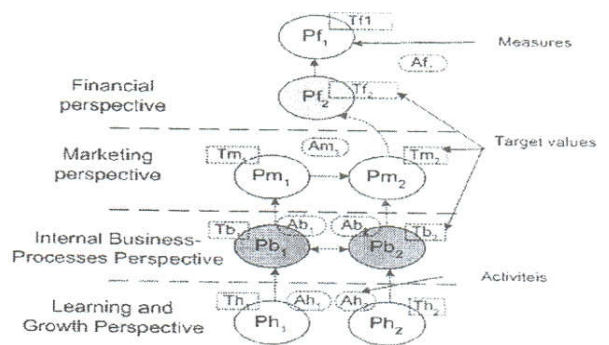


Figure 2. Strategy Map

Strategy map is a framework displayed by table where rows display perspectives and columns represent measures, target values of measures and activities to reach target values of measures. Activities displayed in strategy map distributed by perspectives and the level of management (operative, tactical, strategic) level.

Today more than 300 international companies use Balanced Scorecard [2]. But companies face difficulties implementing this system. Research survey on 60 companies addressed to discover the difficulties in implementation Balanced Scorecard displayed the following difficulties: quantitative measures of intangible asset (75 %) and difficulty do discover the most important measures (73 %) [3].

2.3. Tree of Objectives Modelling

Measuring the influence adequacy of each of the qualitative measures in management traditionally realised in financial analysis by cross-factor analysis. But to assess intangible assets such as costumers loyalty and efficiency of information technologies department using traditional factorial analysis is not well applicable.

Authors suggest use the computer simulation as a method to measure the influence of qualitative measures determined by strategy map to financial outcomes. There discrete-event models used in PowerSim Studio 2005 are suggested as a tool with wide choice of functions, array processing, multi-user support and automating search for

optimal decisions. The main elements in PowerSim are: "levels", "flows", "auxiliaries" and "constants".

Flows are used to transfer resource flows between elements. Flow's input and output are also flows and flow rate can be changed during simulation. A level is the accumulation of the flows that causes the level to change. To achieve a certain level of detail or to aid in the formulation of flow rate equations, it is necessary to model a variable as an auxiliary. Constants are, unlike ordinary auxiliaries, constant over the simulation period.

The analysis of relationships between strategic goals is suggested to start from the analysis of the nature of the object. The nature of the object is represented by business-processes when resource flows transformed through the process with a designated goal.

3. Company as a System of Business-Processes

A business process is a set of logically related tasks to produce a specific product or service with clearly identified inputs and outputs [1].

To build a business-process management system is necessary to define a list of business-processes of a company. A list of referential models of business processes is suggested to use as an initial step of business-process defining. Referential model is a model of successfully implemented and tested business-process model created for key industries that is ready to use on reengineering or developing business-processes on the other companies.

Effective management of the company is realised through the management of important for the strategy business processes. To define these business-processes is necessary to do the following steps:

- To set a list of strategic goals of a company according to the strategy with a list of business-process measures based on content rules analysis of referential business-process models;
- To simulate models that determine the relationship between strategic goals and business-process measures;
- To determine a list of "strategically important" business-processes according to the level of business-processes influence to strategic goals;
- To determine a list of "problematic" business-processes by comparing the factual measures to measures from strategy maps.

The method of business-process defining and determining and formation of an organizational structure based on this method are basic principles of building a process-oriented company. In this instance the management of a company based on business-process management oriented to strategic goals achievement. To manage the company is necessary to manage the

business-processes by influencing to operational business-process measures (Figure 3).

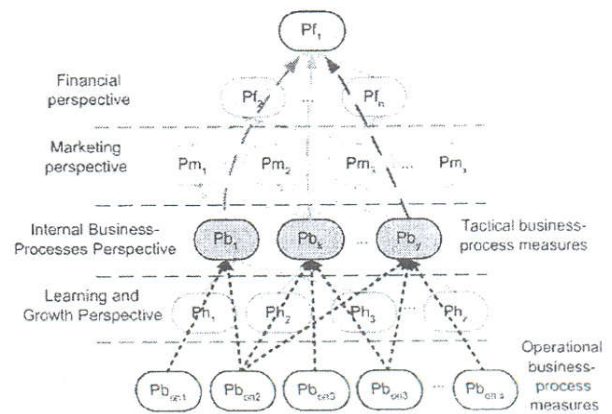


Figure 3. A Correlation between Business-Process Measures and Strategic Goals

3.1. Conceptual Business-Process Modelling

The main aim of "as-is" analysis is a determination of horizontal and vertical resource and information flows that preparation of a base for business-process management and improvement.

The most popular way of business-process modelling is a conceptual modelling. In Russia, among the commonly used techniques used currently are ARIS, UML, and IDEF. One of the disadvantages of these techniques is the fact, that it is impossible to measure the adequacy of management to business-process measures.

As a way to measure the efficiency of business-process management is suggested to use the simulation in order to discover qualitative measures influence to quantitative. It also helps to find the best strategy of managing the business processes.

3.2. Business-Process Simulation

To measure the efficiency of business process management is necessary to build a simulation of business process, using "levels" and "flows" as activities and "auxiliaries" as business-process measures. On figure 4 is shown a general model of correlation between business-process measures and strategic goal in PowerSim Studio 2005 model.

3.3. Business-Process Management Model

The model of business-process management is based on the algorithm of choosing managerial impact according to business-process measures and their values. The classification of business processes is realised on the definition of business-process as a set of logically related tasks to produce a specific product with clearly identified inputs and outputs (Figure 5). The following criteria are used in the simulation:

- Time criteria T , defined as a total time of n activities requires to be executed (1);

$$T = \sum_{i=1..n} t_{activity_i} \quad (1)$$

- Cost criteria C , defined as the sum of n activities costs and cost necessary to transform resource flows between activities with m "flows" (2);

$$C = \sum_{i=1..n} c_{activity_i} + \sum_{j=1..m} c_{flow_j} \quad (2)$$

- Quality criteria Q , defined by characteristics of business-processes inputs and outputs;
- Efficiency criteria E , defined as a ratio of inputs and outputs of measures.

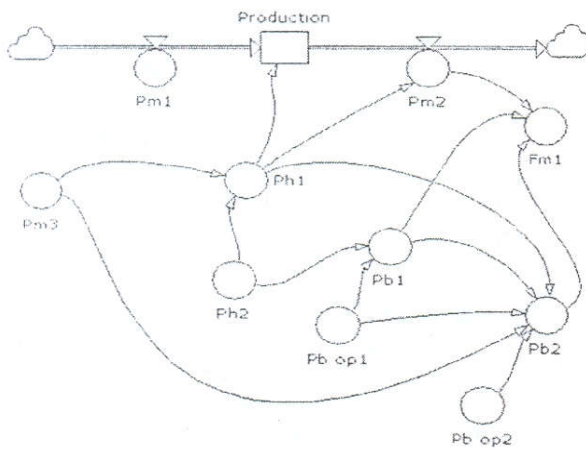


Figure 4. The Correlation between Business-Process Measures and Strategic Goals in Simulation

As it follows from figure 5, the managerial impacts classified by following:

- Impact to a set of activities (parametrical impact). Impacts include adding, deleting, change, accumulating and scattering business-process elements;
- Impact to the control of activities (controlling impact). Impacts include increasing/decreasing the number of control and check points;
- Impact to a sequence of activities. Impacts include parallelising, serialising and reordering;
- Impact to relationships between activities. Impacts include standartising/destandardising of resource and information flows inside the business-process;
- Impact to a relationship between business-process and business process environment. Impacts include adding/deleting business process activities to/from environment: integration/disintegration; in-shoring/off-shoring.

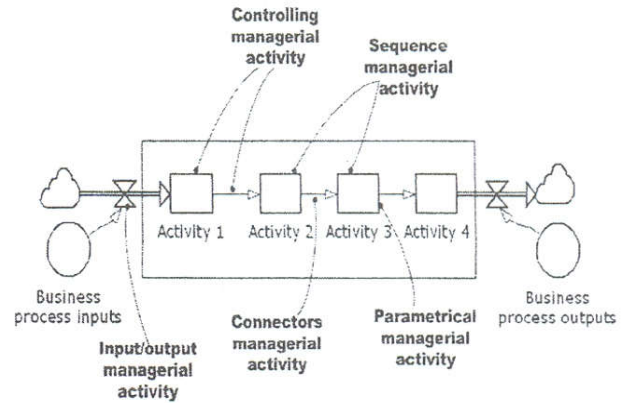


Figure 5. Business-Process in Simulation Model

The mechanism of determining managerial impacts to each of the business-process criteria is obvious. That is why the algorithm of choosing the managerial impact according to business-process measures in strategy map is developed. This algorithm is a base of a business-process management model working in accordance with business-process measures.

Therefore, using computer simulation, the efficiency of managerial decision can be tested that assist managers to choose the best way to align the company' strategy.

4. Implementation of Computer Simulation in the Management of Business-Processes

The selecting strategy mechanism based on content rules analysis, performance management system and measuring adequacy of management to business-processes model were practically approved on the light industry factory of Republic Bashkortostan. Models of measuring adequacy of management to business-processes are designed and approved to the credit granting business-process in the bank (Figure 6).

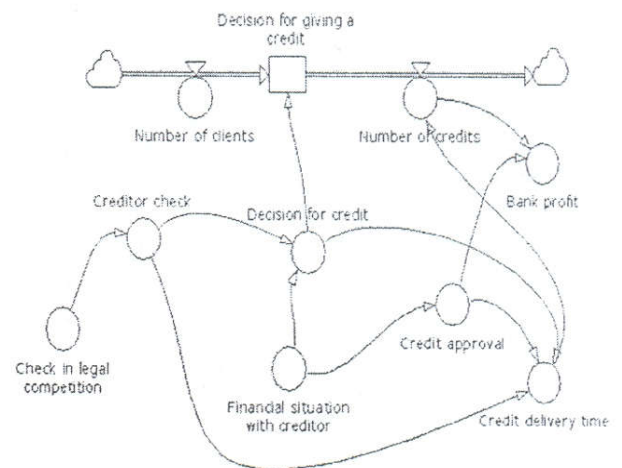


Figure 6. Simulation of Credit Granting Process in Bank

5. Conclusion

Using a computer simulation in business-process management is necessary to build a strategy-focused and business-process oriented company. The following steps are described to build a company's management model:

- The selecting strategy mechanism from the set of strategies by using content rules applied to company's environment and internal capabilities;
- The method of strategy-focused company's performance measurement system;
- The model of measuring the influence of qualitative measures determined by strategy map to financial outcomes;
- The model of business-process management based on the algorithm of selecting the managerial impact in accordance with business-process measures.

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