Combined Use of BSC and DEA Methods for Measuring Organizational Efficiency

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Abstract

Although financial indicators are most often used to measure organizational efficiency, contemporary research suggests that more consideration should be given to non-material factors that can be enveloped by different non-parametric techniques. However, there is no method powerful enough to cover all the relevant aspects of the efficiency problem, i.e. each of them has its advantages and disadvantages. The paper discusses possible combined use of Balanced Scorecard (BSC) method and Data Envelopment Analysis (DEA) in the measurement of organizational efficiency, starting from the deficiencies of the single method use. The main goal of the research in the paper is to show that by combining these methods certain deficiencies in their independent application are eliminated, as well as to indicate the possibilities and limitations, advantages and disadvantages of their combined application. The paper explains that if BSC method is applied first, as a framework for defining goals and performance measures, and then four interactive DEA models are developed, in order to evaluate efficiency in each of the perspectives, relevant synergetic effects will be achieved.

Keywords: Balanced Scorecard, Data Envelopment Analysis, organizational efficiency, combined use of methods, decision support systems
JEL classification: D24, D57, M21

Introduction

Modern enterprises are complex systems, composed of a multitude of interdependent and interactive subsystems in which managers rarely face with laboratory, well-structured problems, and much more often with management problems or real-world problems that are unstructured, undefined or insufficiently well defined. Under these conditions, measuring organizational performance is a major challenge.

One of the basic indicators of business success is efficiency, which is reflected in the achievement of the highest results (outputs) with the lowest possible investments (inputs). Traditionally, financial indicators from balance sheet and income statement are used to measure the efficiency of the company or its organizational parts. However, contemporary research suggests that, in addition to financial indicators, consideration should be given to non-material factors, which can be covered by non-parametric techniques, such as Data Envelopment Analysis (DEA), Balanced Scorecard (BSC), Stochastic Frontier Analysis (SFA) and many other methods.

The creators of the DEA, the authors Charnes, Cooper and Rhodes (1978) have proposed a mathematical approach to calculate the efficiency basd on non-parametric technique, which proved to be appropriate for the evaluation of

operations of not-for-profit organizations, since it allows the usage of alternative indicators.

Balanced Scorecard concept is based on the premise that companies can no longer achieve a sustainable competitive advantage by relying solely on material resources, but it is necessary to focus on the development of the so-called "intangible assets" and "intellectual capital" (Domanović et al., 2014). According to Kaplan et al. (1992), the BSC enables the integration of different indicators derived from the strategy, retaining the financial indicators of past activities, but also adding indicators of the future activities, which are carried out explicitly by translating the strategy into tangible targets and indicators. In this way, the activities of the company are directed towards achieving the defined goals in order to create a unique value, in accordance with the strategy.

However, not one method is so powerful that it can cover all relevant aspects of the explored problem situation, i.e. each of them has its advantages and disadvantages, possibilities and limitations. It is precisely the deficiencies in the individual use of methods that provide a space for their combined use in different ways (Mingers et al., 1997). Previous research has shown that it is very useful to combine the BSC method and methods of multi-criteria decision making, such as, for example, Analytical Hierarchical Process (Domanović et al., 2014) for performance measurement and strategy evaluation. However, when it comes to organizational efficiency, a number of papers suggest an integrated application of the BSC and DEA methods (Amando et al., 2012; García-Valderrama et al., 2009; Eilat et al., 2006). However, there is still no single model with clearly defined sequence of steps in the application of these two methods in order to encompass the multidimensionality of the efficiency concept.

Starting from previous considerations, the subject of research in the paper is the combined use of the Balanced Scorecard (BSC method) and the Data Envelopment Analysis (DEA method) for measuring organizational efficiency. The main aim of the research is to show that combined use of these methods eliminates some of their individual shortcomings in measuring the organizational efficiency. Also, the paper points out the possibilities and limitations, advantages and disadvantages of their combined application.

Organizational efficiency

The complexity of the concept of efficiency is manifested through the diversity of definitions that describe it. The broadest accepted definition is that the efficiency is a requirement to achieve the highest possible result/output with the given inputs or to achieve the result with the lowest possible inputs. It is important to distinguish this concept from effectiveness, which, in general, refers to the degree of accomplishment of set goals (Sumanth, 1994). Therefore, efficiency is the question of the input and the transformation process, while the effectiveness is focused on output (Tangen, 2004). In the simplest case of an organization that uses one input (cost, engaged assets, etc.) to produce one output (profit, revenue, etc.), efficiency is as the output-input ratio: *efficiency = output / input*.

Traditionally, the financial indicators from the regular financial statements are used to measure the efficiency. The balance sheet contains information on the assets, liabilities, and equity of the entity as of the reporting date. It provides information about the liquidity and capitalization of a company at a specific point in time, while the income statement describes revenue, expense and realized profit / loss. Hence, the most common criteria for assessing the efficiency are: profit, return on investment and the profit ratio (Domanović et al., 2011). In addition to the return

on investment (ROI), both ROE (return of equity) and ROS (the rate of return on sales) are often usedas the relevant profitability indicator.

However, although financial indicators have an indispensable role in measuring the performance of the company, the precision and objectivity of its numerical expression, do not, however, allow the inclusion of all relevant factors that affect efficiency. Inter alia, different organizational characteristics affect efficiency. Research shows that organizational structure, in particular the control system, is a relevant factors of efficiency (Ostroff et al., 1993). The age and size of an organization are also factors of efficiency (Glisson et al., 1980). In this respect, we can talk about *organizational efficiency*.

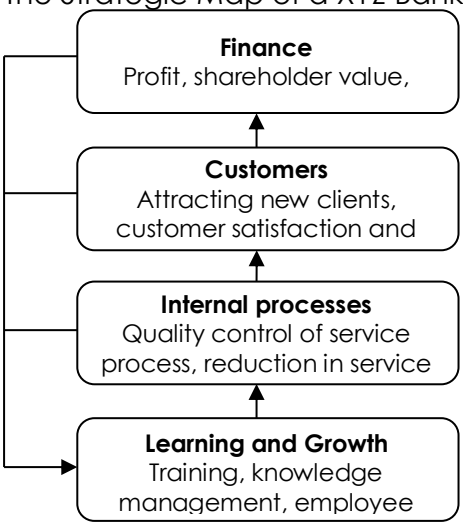
For the purpose of holistic observation of organizational efficiency, certain methods have been developed, which involve in the analysis of both quantitative and qualitative attributes. Thus, modern approach to performance measurement does not suggest the use of purely financial *or* non-financial criteria, but their simultaneous and complementary analysis.

BSC-DEA Model for Measuring Organizational Efficiency in Banking Sector

Starting from the previous research (Amando et al., 2012; García-Valderrama et al., 2009; Rickards, 2003), we propose one way of combining the application of BSC and DEA methods for measuring the efficiency of organizational parts of a bank in Serbia (hereinafter : XYZ Bank), whose identity will not be disclosed. Information about the bank, such as data on vision, mission, strategy, objectives and other planning decisions have been collected through unstructured interviews with employees, as well as from secondary sources, such as bank publications.

The focus is on the proposal of the model for measuring the organizational efficiency of all branches of XYZ Bank, which belong to the Kragujevac Regional Center, in order to determine their relative efficiency and formulate recommendations for the future operation of efficient and inefficient observation units in accordance with the Bank's strategy. There are 10 branches and they represent decision-making units (DMUs). The initial phase in the integration of the BSC and DEA method is the formation of a strategic map where the objectives of the XYZ Bank are presented within each of the BSC perspectives (Figure 1).

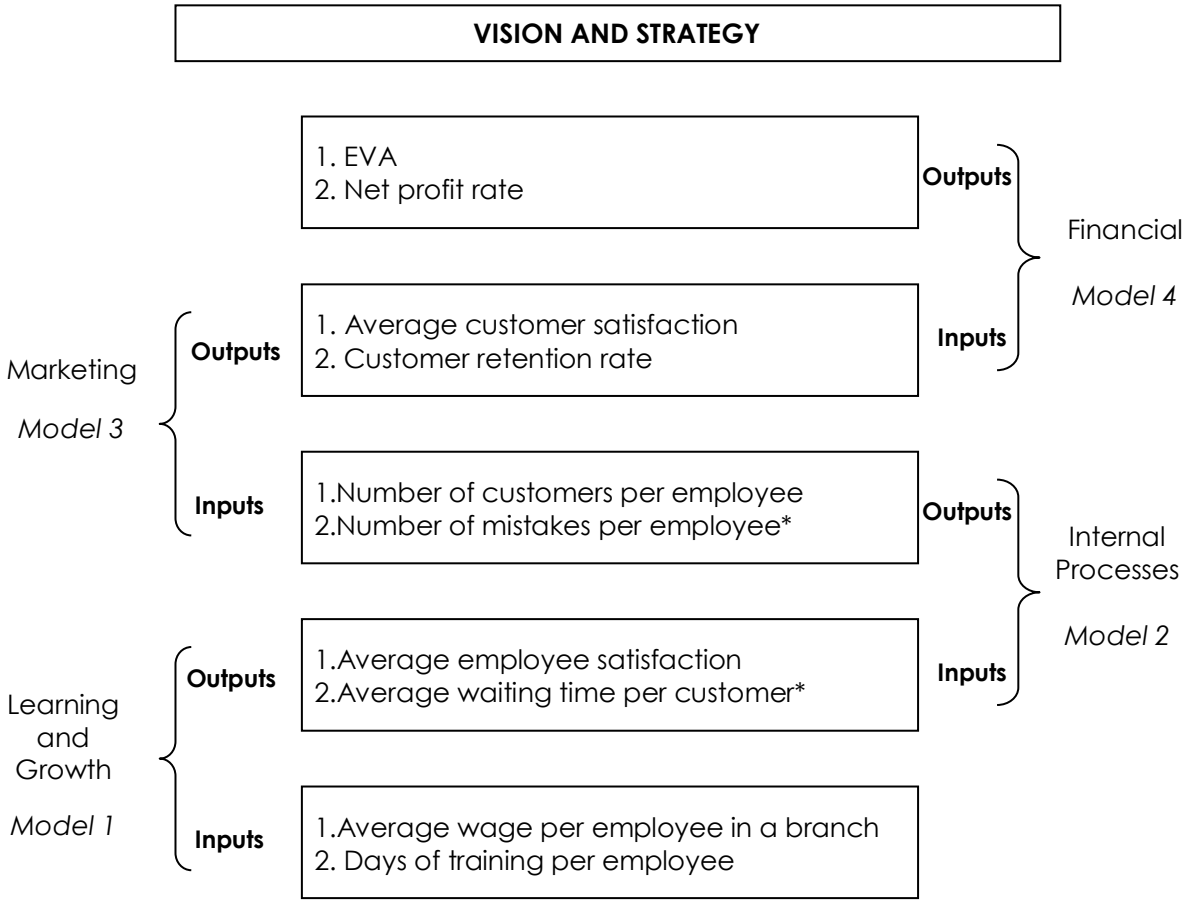
Figure 1
The Strategic Map of a XYZ Bank



Source: Authors' illustration

The next step involves creating a Balanced Scorecard as a strategic management tool that includes strategic goals, critical success factors, and performance indicators of XYZ Bank (Figure 2). All these elements are interactive.

Figure 2
DEA Models



Note: Adverse outputs are subject to the following transformation: $Y_{ro} = (MaxY_{rj}) - Y_{ro} + c$ This transformation was proposed by Dyson et al. (2001)
Source: Authors' adaptation according to Amando et al. (2012)

Table 1 presents the BSC developed for the XYZ bank. The BSC for XYZ Bank shows an overview of some of the most important strategic goals, critical success factors, and performance indicators presented through four key, interdependent BSC perspectives. It serves as a framework for the development of the DEA model, which uses performance indicators as inputs and outputs. In accordance with the recommendation of Amando et al. (2012), racia were taken as inputs and outputs. Thus, a BCC (Banker et al., 1984) model, which assumes variable return to scale, is used. In particular, four DEA models (one for each perspective) have been developed.Each model has two inputs and two outputs. The outputs of the first model were used as inputs for the next model, and so for each of the following. In this way, the interdependence between the BSC perspectives is encompassed. In doing so, the decision-making units should remain flexible, since the weight coefficients for the same factors (outputs that are used in the next model as inputs) can be changed in different models. The proposed DEA models are shown in Figure 2.

Table 1
BSC of the XYZ Bank

	Strategic objectives	Indicators
Financial Perspective	Creating value for shareholders Maximizing profitability Minimizing risk	Earnings per share (EPS) Economic value added (EVA) Relative profit rate Cash flow Value at risk (VaR)
Marketing / Customer Perspective	Attract new clients Improve customer satisfaction Create loyalty	Number of new clients in the corporate banking sector per employee Number of new clients in retail banking per employee Customer satisfaction indices Number of client complaints Customer retention rate Relative market share
Internal Business Processes Perspective	Create a high quality service Reduce the service delivery time Innovation in the provision of services	Number of serviced clients per branch Number of serviced clients per employee Number of mistakes Average time needed for troubleshooting Average waiting time in line at the counter Number of transactions via electronic banking Number of transactions via mobile banking
Learning & Growth Perspective	Effective knowledge management Continuously develop the skills of employees High level of employee satisfaction High level of employee motivation	Managers retention rate Days of training per employee (year level) Average wage costs per employee Employee satisfaction indices

Source: Author's illustration

This model can be used to measure the organizational efficiency of the branch offices in order to identify their relative efficiency. The application of this model makes it easier to define the steps and initiatives to be taken to maintain or improve the efficiency level of the observed organizational units in accordance with the company strategy. It may be used in other companies in service sector, beside the banks with minor adjustments.

Conclusion

This paper analyses a possible way of integrated application of the Balanced Scorecard (BSC) and Data Envelopment Analysis (DEA) methods. Based on the known key theoretical and methodological features of both methods, the paper presents a practical example which shows that if the BSC method is first applied, as a framework for defining goals and performance measures, and then the four interactive DEA models are developed, in order to evaluate efficiency in each of the

BSC perspectives, certain limitations of their individual application will be removed and synergy will be created.

The paper presents an illustration of a possible way of synergistic application of the BSC and DEA methods, the so-called BSC-DEA model for measuring the relative efficiency of bank's branches. This illustration aims to motivate and support the measurement of organizational efficiency based on the strategy, taking into account not only the material but also the intangible factors of efficiency in the banking sector. In this way, we show that the application of these methods can be equally effective in profit organizations, and not only in non-profit sector, where the Data Envelopment Analysis method is more often applied.

Practical research implications are reflected in defining the steps for applying the BSC-DEA model in any company, in order to identify the relative efficiency of their organizational units. In addition, in this way, it is possible to raise a number of relevant issues, which may indicate the causes of inefficiency of the organization and facilitate the identification of the necessity of change. Of course, this approach to combined application of the methods can be adjusted depending on the strategy of each specific company and various situational factors, in terms of creating a specific BSC and choosing different inputs and outputs in DEA models.

The key limitation of work is reflected in the lack of empirical application of the presented model, which implies the next step in the research. The second important limitation relates to the fact that none of the two methods provide complete objectivity in determining the weight coefficients in the DEA method. Therefore, in the future, it is possible to explore whether it is possible to combine BSC and DEA with some of the multi-criteria decision-making methods, such as, for example, AHP method, as a third method, in order to further evaluate organizational performance. Another possibility of future research is the application of the BSC-DEA method for measuring organizational efficiency in successive time periods in order to obtain information on the success in managing the efficiency of the analysed organizations.

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